# Capabilities for Big Data: An Empirical Study in a Global Pharmaceutical Company

Thesis



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THE OPEN UNIVERSITY BUSINESS SCHOOL

# Capabilities for Big Data: An Empirical Study in a Global Pharmaceutical Company

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# Abstract

The increasing availability of large quantities of digital data (Big Data) and advanced analytic tools is driving many industries to change their practices. Currently there are limited theoretically informed, in depth empirical studies of the processes and activities that needed to leverage Big Data strategically. This research is a response to calls by international scholars for more in depth and theoretically informed studies of on Big Data (e.g. Brynjolfsson et al., 2011; McAfee et al., 2012; Wamba et al., 2015; Braganza et al., 2017; Mikalef et al., 2017).

The study frames Big Data as a new resource and adopts the Resource-Based View (RBV) and the Dynamic Capabilities (DC) perspective in order to explore the enhancement of existing capabilities and development of new capabilities required to leverage this new resource. The empirical context of this study is a global pharmaceutical company. Employing a qualitative in-depth case-study approach, this research investigates why a Multinational Corporation (MNC) in the pharmaceutical industry adopted Big Data adoption and how it identified and developed capabilities for this new resource. Data from 24 in-depth interviews and observations of Europe, the Middle East and Africa (EMEA) and Global managers in two project teams were analysed and synthesised using thematic analysis methods.

The findings from this study show that the use of Big Data required new and enhanced capabilities that were developed through the action of dynamic capabilities, which operated as mediators between existing capabilities and the new and enhanced capabilities. Although some elements of these dynamic capabilities were embedded in the organisational processes, the activities of senior managers played a crucial role in their development and use. Further, the findings show that the organisation's cultural transformation was critical for the operation of the dynamic capabilities identified and the new and enhanced Big Data capabilities. In the case study company the development of a Big Data capabilities was found to be an incremental, extended process.

The study makes a number of contributions. It provides an in-depth case study of Big Data preparation in the specific context of a MNC pharmaceutical company that is of value to both academics and practitioners. It provides a theoretically based and empirically validated model of the development of capabilities associated with Big Data adoption. Finally, it makes a contribution to academic theory by contributing to the ongoing discussion in the academic literature of the utility of the concept of Dynamic Capabilities.

***Keywords*:** Big Data, Digital Environment, Operational Capabilities, Dynamic Capabilities, Pharmaceutical.

# Acknowledgement

I am thankful for God for giving me opportunity and strength to take this most incredible learning journey in my life.

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# Dedication

I Dedicate this PhD Thesis to Memory of My Parents.

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# Abbreviations

| | |
|---|---|
| IDC | International Data Corporation |
| IBM | International Business Machine Corporation |
| CRM | Customer Relationship Management |
| RBV | The Resource-Based View |
| VRIN | Valuable, Rare, Inimitable and Non-Substitutable resources |
| DC | Dynamic Capability |
| MGI | McKinsey Global Institute |
| P&G | Procter & Gamble |
| BI | Business Intelligence |
| ROI | Return on Investment |
| R&D | Research & Development |
| EMEA | Europe, Middle East and Africa |
| IKU | Information Knowledge Utilisation |
| CR | Critical Realism |
| ER | Empirical Realism |
| IS | Information Systems |
| HEI | Higher Education Intuition |
| EDC | Electronic Data Capture |

| | |
|---|---|
| FDA | Food and Drug Administration |
| CPI | Critical Path Initiative |
| MNC | Multinational Corporation/s |
| CA | Competitive Advantage |
| GDSRM | Global Drug Safety and Risk Management |
| SGR | Scientists for Global Responsibility |
| IMI | Innovative Medicines Initiative |
| EHDR | European Huntington's Disease Network |
| EIA | European in Informed Activity |
| CDA | Confidential Disclosure Agreement |
| RCT | Randomized Controlled Trial |
| FASB | Financial Accounting Standards Board |

# Chapter 1: Introduction

## 1.1 Introduction

To become or remain competitive in today's global marketplace organisations are increasingly required to introduce and use a vast number of technological innovations. Against this backdrop, organisations are embracing the increased accessibility of digitally sourced data (Big Data) and the advanced technology required to analyse it. Academics (Bharadwaj et al., 2013; Davenport, 2014; Erevelles et al., 2015; Wamba et al., 2015) and practitioners are indicating that the biggest challenge faced by organisations today is to combine old and new ways of operating businesses in the digital environment.

Motivated by the recent increase in academic and practical/managerial interest in Big Data and the associated phenomenon of developing required capabilities, the aim of this research is to identify how Big Data initiatives are currently managed and implemented in order to drive innovation, in particular in the pharmaceutical industry. Accordingly, the main academic objective was to explore Big Data initiatives, preparation for their adoption, and the required capabilities development processes in a particular pharmaceutical company.

Applying the Resource-Based View (RBV) and Dynamic Capabilities (DC) approach as a theoretical underpinning, this research empirically investigated why a Multinational Corporation (MNC) in the pharmaceutical industry prepares for Big Data adoption and how they identify and develop capabilities for Big Data. This chapter provides an introduction to this research. It explains the background and importance of this study (1.2). It outlines the aim, objectives and research questions guiding the execution of this study (1.3) and highlights the methods and methodologies taken to conduct the research (1.4). Section (1.5) presents the study's contributions to knowledge, while (1.6) presents a structural overview of the thesis.

## 1.2 Background and Importance of the Research

### *1.2.1 Background*

#### *1.2.1.1 Big Data Vs and working definition*

The introduction of the World Wide Web as an electronic platform for business has brought many challenges in terms of market competition in various industries. On a daily basis, enormous volumes of user-generated data are transferred and analysed within and across different business sectors. Technology offers greater opportunity to capture better quality customer data and increase the focus on the customer. However, the large volume and variety of data available to organisations from various sources, such as social networks, the Internet, and mobile devices, presents the challenge of finding new ways of converting the data into actionable insights.

These new types of data are collectively referred to as Big Data, a term whose origins lie in the fact that a huge amount of data is created every day. One of the fundamental reasons for the existence of the Big Data phenomenon is the current extent to which information can be generated and made available, as well as its potential business value i.e. its ability to give organisations a competitive advantage (LaValle et al., 2011; Agarwal and Dhar, 2014; De Mauro et al, 2015). In general, Big Data refers to increasingly large data sets that include heterogeneous formats: structured, unstructured, and semi-structured data. Big Data has a complex nature that requires powerful technologies and advanced capabilities to be successfully leveraged (Khan et al., 2014; Oussous et al., 2018). Although there is still debate on the exact definition of Big Data, its related issues and opportunities are mainly discussed in terms of V's, even though it has not yet been ascertained how many V's there are. The model continues to be extended to reflect the growing interest and experience with Big Data.

In the early days of this research (2013/14) the main characteristics about Big Data as discerned from the published papers and online research were its sheer size (volume), frequency of update (velocity), and diversity (variety), also known as the 3Vs. Most data scientists and related experts had previously defined Big Data by these three characteristics (Laney, 2001; Manyika et al., 2011; McAfee and Brynjolfsson, 2012; Davenport, 2012; Sharma, 2014). As an example, Laney (2001) defined Big Data as consisting of large volumes of extensively varied data that are generated, captured, and processed at high velocity. The International Business Machine Corporation, IBM (2013) likewise defined Big Data as: '*High-volume, high-velocity, and high-variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision-making.*' Gantz and Reinsel (2012) extended the definition of Big Data to 4Vs: volume, variety, velocity, and veracity, where veracity was added to describe the accuracy or degree of trustworthiness of the data. The key features of Big Data identified by Gantz and Reinsel (2012, p. 910) volume, variety, velocity and veracity - have been widely accepted as the '4Vs', or the four key attributes of Big Data.

Key discussions that were held between academics and practitioners on this subject concluded that the size of the data-set is no longer the defining parameter of Big Data, but rather the insights and the value that the volume and variety of data offer (George et al., 2014). Dealing effectively with Big Data requires one to create value against the 4V's, although a fifth V, value, relates to the desired outcome of processing Big Data.  Value in this case refers to the degree to which the data can impart to an organisation a useful business and economic advantage, resulting from the organisation using the data to make decisions based on insights that may have previously been considered beyond reach (Fan and Bifet, 2016). The value of Big Data also lies in its potential to improve an organisation's operational activities through the generation of unique knowledge and insights, which in turn leads to competitive advantage (Banasiewicz, 2013). What benefits organisations perceive as a 'Value' depends on their strategic goals for adopting and using Big Data (Ghoshal et al., 2014, Wamba et al., 2015). Certainly, economic value can be measured by an organisation's increase in profit, business growth, and competitive advantage resulting from Big Data adoption (Davenport, 2006). For example, organisations that rely on Big Data to guide organisational strategies and day-to-day operations are expected to perform better financially than organisations that do not (LaValle et al., 2011, McAfee and Brynjolfsson, 2012). Thus, this research followed a process that was put into effect to make sense of this new phenomenon, in which Big Data was defined using five Vs: Volume, Velocity, Variety, Veracity and Value, as illustrated on the picture 1.1 below.

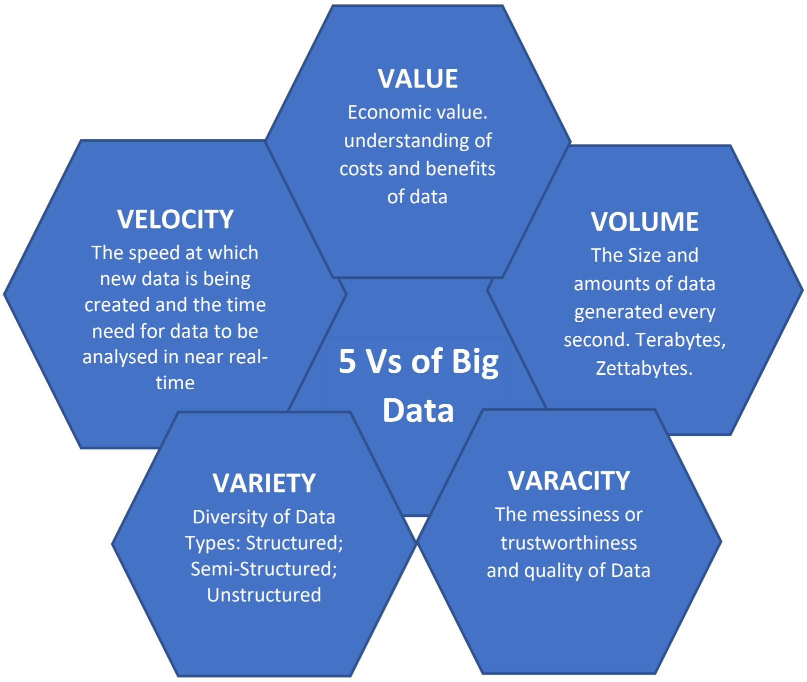



*Figure 1.1: Five Vs of Big Data: Volume, Velocity, Variety, Veracity and Value (developed based on the source: IBM Big Data platform - Bringing Big Data to the Enterprise, 2014)*

It has been suggested (Boyd and Crowford, 2012; Bharadwaj et al., 2013; Davenport, 2012), that the 5Vs of Big Data are the main challenge for Big Data management. However, these five dimensions are complementary to each other, and as one dimension changes, there is a tendency for the others to change too (Laney, 2001; Gandomi et al., 2014; Haider, 2014; Hallman et al., 2014). This makes Big Data more complex than the kind of digital data that had been held and dealt with by companies in the past.

- ***Working Definition***

For clarity, it must be acknowledged that although this research conformed to the existing practice of describing Big Data using five Vs as mentioned above, the challenges and opportunities associated with each individual dimension of Big Data was not the focus of this research. Rather, this research looked at Big Data as a whole, as a new resource (as an "*information asset*"), that requires new technologies and capabilities for its transformation into value. Thus, in this research Big Data represents a new resource, characterised by high Volume, Velocity, Variety, and Veracity that together demand new capabilities, and innovative forms of information processing for enhanced insight and the resulting transformation into Value (De Mauro et al., 2015).

It must also be recognised, that this is a developing field, and by the end of this research some authors (Emani et al., 2015; Gandomi and Haider 2015; Oussous et al., 2018) and institutes (like the Institute of Electrical and Electronics Engineers (IEEE) refer to yet more V's ( 6Vs; 7Vs; and in some cases even 10Vs) (Patgiri, and Ahmed, 2016; Firican, 2017) in order to better define Big Data. Additional V's include, for example, Verification (where the processed data conforms to certain specifications) (Emani et al., 2014); Validation (where the purpose of the data is fulfilled) ( Gao et al., 2016), Visualization (where large amounts of data are rendered easy to read and understand) (Wang et al., 2015; Data Technology, 2019); Variability (where there are changes in the structure of the data and in how users may wish to interpret that data) (Fan and Bifet, 2016; Emani et al., 2014); Volatility (which considers the retention of otherwise transient structured data that are produced by everyday transactions) (Khan et al., 2014), and Validity (referring to the correctness and accuracy of data with regard to its intended usage) (Khan et al., 2014; Patgiri, and Ahmed, 2016).

Currently, although there is a great deal of controversy and even confusion about the V's of Big Data, and significant ongoing debate over how many V's exist in total, this study was based on a definition of Big Data that followed the most widely accepted and core V's, and these core dimensions are not likely to change regardless of how many more V's are identified by researchers beyond this point.

From discussed above it can be summarised that Big Data has become a ubiquitous term in many parts of business and academia. The business community is fully embracing ways of utilising Big Data to its advantage, and from a business perspective Big Data refers to the availability to organisations of massive amounts of heterogeneous and continuously-updated information that can confer business value – that is, it can generate competitive advantage (LaValle et al., 2011; Agarwal and Dhar, 2014; De Mauro et al, 2015). Practitioners agree that the availability of such information creates both challenges and opportunities for organisations that had never existed previously (Davenport, 2014; Gupta and George, 2016; Wamba, 2016; Mikalef et al., 2017). The dramatic increase in the use of digital devices, such as smart phones and sensors, has also increased the rate of data creation, with such data offering personalised information about customers, such as their location, demographics, and past buying patterns, all of which can be analysed in real-time to create real customer value (Gandomi et al., 2014). George et al. (2014) highlight that this micro-data provides rich information about individuals' behaviours and actions, and real-time customer feedback also makes it possible to monitor and understand the areas where a product or service is failing. Furthermore, such information allows quicker and more effective responses (McAfee and Brynjolfsson, 2012). For example, research findings from the McKinsey Global Institute (MGI) indicate that companies that use data-driven decision-making are 5% more productive and 6% more profitable than their competitors. Many industries such as (among others) healthcare, finance, retailers, education, and transportation are investing in Big Data to understand the markets and customers, to make smart trading decisions, and to improve their operational efficiency.

The UK Parliamentary Office of Science and Technology (2014) estimates that for its efficiencies, innovation and business creation, Big Data was worth £25 billion to UK businesses in 2011. Furthermore, they predicted that it would reach an annual value of £41 billion by 2017. These predictions are currently becoming reality. As the recent findings of the world's leading research and advisory company (Gartner, 2017) suggest, not only is Big Data adoption in high demand, but interest is even greater. For example, Gartner's estimates indicate that Big Data investments in the healthcare and pharmaceutical industry accounted for nearly \$4 billion in 2017 alone, and this investment is expected to grow more than 15% over the next three years. Figure 1.2 below illustrates Big Data analytics expected adoption rates by the industry by the year 2017.

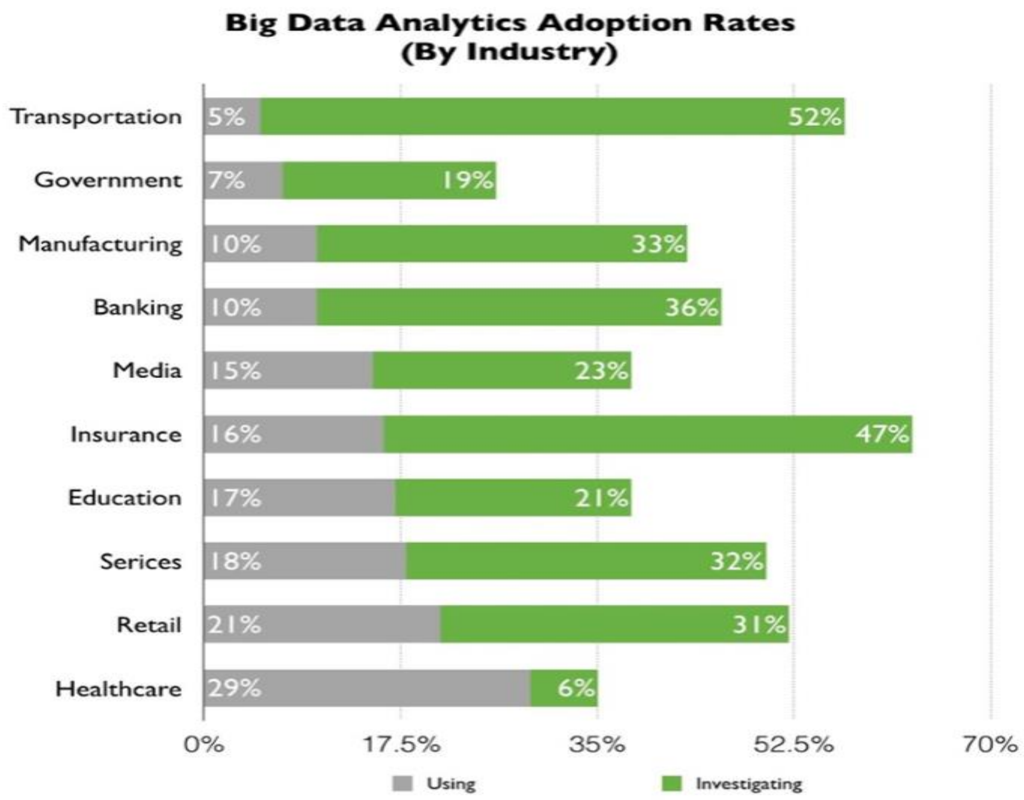


*Figure 1.2: Big Data Analytics Adoption Rates by Industry (Research findings based on Gartner, 2017)*

As illustrated above there are already many instances where Big Data has proved to be a valuable resource for many industries. Procter and Gamble (P&G), is a striking example of a company which has successfully embraced Big Data. This company well knows the value of understanding consumer behaviour (P&G, 2014) and as a result is adopting Big Data practices ahead of many other companies, including its rivals. For the past five years P&G and Google have annually exchanged teams of staff, with Google seeking to learn about advertising, and with P&G wishing to learn how to make decisions based on the analysis of real-time data that are both quick and reliable. In each company, managers and employees are given the opportunity to upgrade their digital skills, while business leaders within P&G have identified no fewer than 88 business processes that are being redesigned and streamlined to operate in real-time (P&G, 2014; Galbraith, 2014).

Tesco is another company which has successfully made use of Big Data and advanced analytics, introducing a loyalty card in 1995 and using it as a vehicle for the systematic collection and analysis of shopping data. Tesco realised the value of the insight these cards would give with regard to customer behaviour patterns and the company began processing a huge volume and variety of data from these cards, enabling them to better segment and target the mailings of vouchers and coupons to customers, resulting in a huge increase from 3% to 70% in the rate of coupon redemption (MGI, 2013). The company has also since gradually integrated online and social-media information to support daily decision-making. A case study on Tesco carried out by Business Intelligent (BI) shows that the company's insight-driven commercial strategy has contributed to sustained profitability (BI, 2015).

However, there are also cases in which Big Data is available but not used. Before moving forward on Big Data initiatives, companies typically seek a clearer understanding of the potential return on investment (ROI); especially given the perceived high cost of systems and resources required to implement Big Data solutions. Figure 1.3 below illustrates the obstacles preventing retailers from using Big Data.

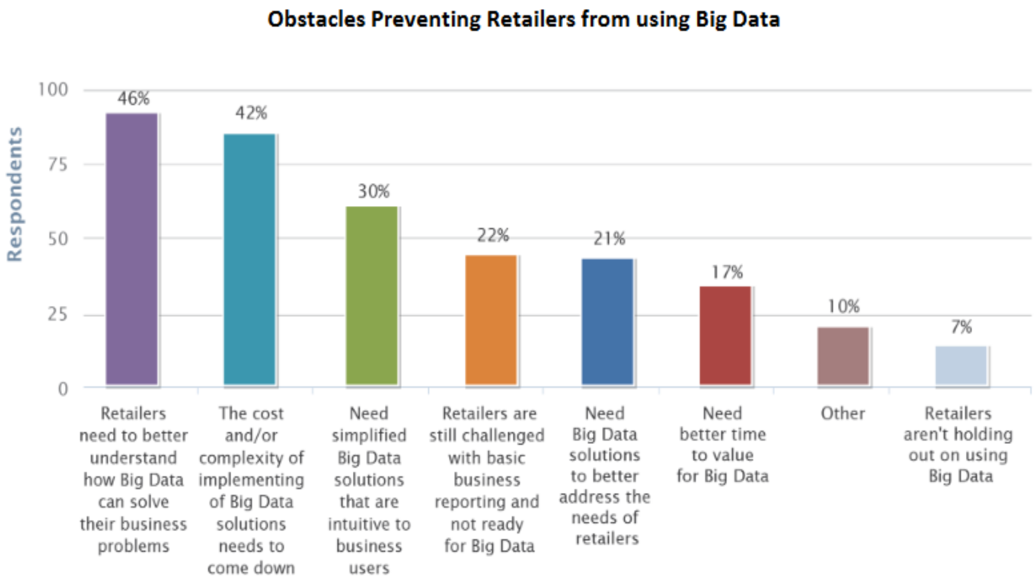



*Figure 1.3: Obstacles Preventing Retailers From Using Big Data (Source: 1010data, 2014)*

A study undertaken by 1010data (2014) showed that 41% of retailers struggled to achieve meaningful and consistent interpretation of data. 38% indicated that an inability to analyse this kind of data was the main problem, while 34% struggled with accessing and integrating the relevant systems. In addition to the insight that could be delivered from the analysis of Big Data, Lukoianova and Rubin (2014) argue that depending on its origin, data processing technologies, and the methods used for data collection, the use of Big Data can result in biases, ambiguities, and inaccuracies all of which need to be identified to reduce errors and improve the accuracy of generated insights. This raises the important issue of Big Data quality and trustworthiness, doubts over which can prevent it being adopted or used.

On the other hand, the successful adoption of a new resource is often not an easy task to achieve, as existing systems and processes need to be built up over many years, and employees' knowledge of the new environment can be limited. The interaction between organisations and digital technology is '*complex*' because it is influenced by many factors, including an organisation's structure, routines, business processes, politics, culture, internal and external environment, and management decisions (McAfee and Brynolfsson, 2012). Technology companies (Google, Amazon, e-bay, Netflix) are the native collectors and users of Big Data because their internal organisation and capabilities are adapted to the use of that resource. Conversely, although some companies (pharmaceuticals, insurance, advertising, financial services and retailers) from more traditional sectors may have undertaken projects to assess this new kind of resource, not all are fully ready to exploit Big Data (Galbraith, 2014). For example, the McKinsey Group (2013) states that despite the important role of Big Data in value creation, many organisations appear to be at an early stage of learning how to exploit it, and have not developed the right capabilities to do so. O' Reilly and Tushman (2016) suggests that they will need to adapt environmental change in order to remain successful. Although Big Data science is becoming a reality and may not yet have fully arrived, it is time for organisations to get ready for it. There is a need to learn more about the resource of Big Data itself, and to build capabilities related to its use. Thus, when resource such as Big Data is freely available organisational capabilities to successfully deploy, coordinate, and use this resource are not freely distributed (Ethiraj et al., 2005).

### *1.2.2 Big Data in Pharmaceutical Industry*

Despite the acknowledged risks, time and costs associated with pharmaceutical development, the pharmaceutical industry is highly innovation-driven (Sadat et al., 2014). The industry contributes to human well-being by providing new medicines to counter a range of diseases, and has grown into a major sector of the global economy (Taylor, 2015). Generally, the pharmaceutical industry consists of number of very large multinational corporations (MNC) such as for example AstraZeneca, Merck, Novartis, Roche and Pfizer. These companies are collectively known as Big Pharma based on following criteria: the sales per year which should be above 2 billion USD; international presence, which includes: presence in USA, Europe, and Japan; ongoing Research and Development in several therapeutic areas; marketing in at least five different therapeutic areas and; establishment of fully integrated pharmaceutical operations, including internal R&D, manufacturing, clinical trials, regulatory considerations, marketing, and sales (Chandler, 2005; Hedner, 2012).

R&D in the pharmaceutical industry is very expensive and time consuming; it usually takes about 8 to 12 years from the discovery of a new drug to the time it reaches the consumer market, entailing an average cost of $800-900 million (Taylor, 2015). A crucial element of the process involves developing the drug, an activity which dominates the overall cost, particularly as a result of the clinical trials which follow the pre-clinical development before approval by the regulators (Chandler, 2005). In 2004 the US Food and Drug Administration (FDA) introduced the Critical Path Initiative (CPI) with the intention of improving the drug development process by incorporating recent scientific advances, such as genomics (which relies on knowledge of the genome and DNA data of an organism) and other advanced technologies into the process (Woodcock and Woosley, 2008; Kumar, 2011). Although still in its early stages, an effort has been made by both the pharmaceutical industries and by regulatory authorities to adopt new technologies such as: Electronic Data Capture (EDC); innovations in analytics, such as predictive modelling (Davenport, 2012; Gandomi, 2014), and new visualisation tools (Costa, 2014). As such developments continue to accelerate in the industry, so do the opportunities to embrace insights from Big Data (Groves, 2013; Liu, 2014; Costa, 2014; Wang et al., 2018).

The current abundance of Big Data and the availability of useful analytical techniques is predicted to enhance future innovation and feed the drug development pipeline in the pharmaceuticals industry (Sadat et al., 2014). It has been predicted (Kumar, 2011; Cattell et al., 2013; Costa, 2014) that effectively utilising Big Data will help pharmaceutical companies accelerate the identification and development of new drug candidates (Liu, 2014), resulting in more personalised medicines that will significantly improve patient care, and offering scope for reimbursement for their development. However, to qualify for reimbursement, pharmaceutical companies are now required to demonstrate through clinical trial results, that their new drugs offer significantly more clinical benefit than existing alternatives and also reduce the total cost of care (Paul et al., 2010; Ernst and Young, 2010). The approach taken by personalised medicine involves integrating genomics technologies (Costa, 2014) and other advances with clinical and family histories in order to more coherently tailor therapeutics to individual patients (Kumar, 2011). These strategies require new forms of data management capable of visualising various data types collected from multidisciplinary knowledge and cross-functional interaction (Oracle, 2014; Wang et al., 2018). One particular pharmaceutical business transformation with regards to Big Data focuses on cross-functional collaboration, whereby knowledge delivered from data can be uniformly leveraged (Kumar, 2011; Costa, 2014). However, translating basic research into a form that has clinical utility requires a unifying IT platform that lets the researchers themselves access, integrate, and analyse information from multiple data sources. In addition, it also demands the use of a diverse range of tools to derive the knowledge that is needed (Wang et al., 2018). Yet the traditional silo data management approach, and the way in which the current use of existing IT infrastructure does not encourage internal and external collaboration, limits the ability of pharmaceutical companies to integrate Big Data into their operations (Wamba et al., 2015). Instead of providing support for the dynamic integration of Big Data thought processes, mostly such traditional approaches end up either restricting innovation (Sadat et al., 2014) or rigidly dictating (Kumar, 2011) how users can extract knowledge from such data. Thus, the ability to manage and integrate data generated at all stages of the value chain, from discovery to real-world use after regulatory approval, is a fundamental requirement to allow pharmaceutical companies to derive benefit from technology and Big Data trends (Deloitte, 2015). The value chain of pharmaceutical innovation or drug innovation as the meaning implies is illustrated in Figure 1.4.

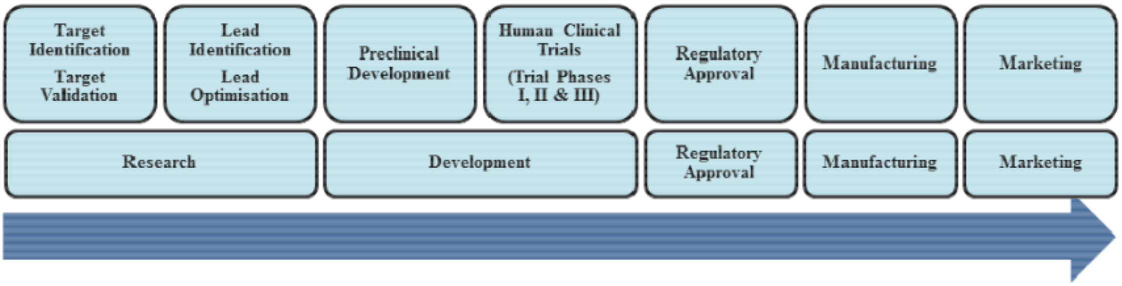



*Figure 1.4: Pharmaceutical Value Chain (Source: Sadat et al., 2014)*

The enormous variety of data (structured, unstructured, and semi-structured) generated from pharmaceutical operations including the R&D process itself, clinical trials, and marketing makes healthcare data both interesting and challenging. To generate the ability to use and share data requires improved linkages across different functions such as, for example, discovery, clinical development, and medical affairs. Furthermore, implementing end-to-end data integration requires several capabilities, including systems that will allow connectivity (Wamba, 2016), people with the ability to establish cross-linkages between different functions (Costa, 2014 ;), and analytics to extract value (Wang et al., 2018). In addition, pharmaceutical companies must understand and reduce the legal, regulatory, and privacy risks associated with a collaborative approach (Sadat et al., 2014).

Leading consultancy companies (e.g. Deloitte, McKinsey Group, Gartner) are indicating that pharmaceutical companies generally avoid overhauling their entire data-integration system at once because of the logistical challenges and costs involved. However, very limited empirical academic evidence exists to suggest that some innovative companies in the healthcare industry, including pharmaceuticals, have started to gain access to the promising new trends and knowledge that Big Data offers (Groves et al., 2013). Thus, successful Big Data initiatives are still rare within MNC in the pharmaceutical sector. It is possible that this scarcity can be attributed to the challenges inherent in changing, renewing, and/or innovating their existing capabilities (Deloitte, 2015; Teece, 2010) despite their access to resources, market knowledge, and key technologies.

### *1.2.3 Importance of the Research*

While acknowledging the importance of investment in developing Big Data capabilities, differences exist between competitors in the timing of this effort, in the amount of investment (Murdoch and Detsky, 2013), in the initiative shown by management (Mikalef et al., 2017), and in the internal organisational processes and culture (LaValle et al., 2011) that support these processes. Thus, as with any new technology, it is important to understand the process through which Big Data initiatives and required capabilities development comes about in a company in practice.

An important discussion over the past years has focused on the opportunities and challenges that Big Data brings to organisations (Chen et al., 2012; McAfee et al., 2012; Davenport, 2012). Yet, there is less empirical evidence in the literature (discussed in more detail in Chapter 2) relating to how to overcome challenges regarding successful implementation of this new resource (Bharadwaj et al., 2013; Constantiou and Kallinikos, 2015; Erevelles et al., 2015; Wamba et al., 2015). While the published research on Big Data initiatives and required capabilities development is limited (Mikalef et al., 2017), some studies (Gupta and George, 2016) have investigated what organisational resources are necessary for the success of Big Data initiatives. Arguably some previous studies which looked at what resources were needed to guide Big Data deployment practices provided valuable insight, but little progress has been made on elucidating how this process should be approached and how an organisation can develop relevant required capabilities. Importantly, Wamba et al. (2015) note that there are very few empirical studies that focus on developing explanatory and predictive studies for a better understanding and growth of knowledge in these domains (Big Data and required capabilities). Therefore, there is still a need for greater insight into how organisations may prepare for Big Data and develop required capabilities in order to benefit from its value.

From a capability perspective, organisational growth and survival are dependent on how well a business can manage its resources through its organisational capabilities (Teece et al., 1997). Capability development, on the other hand, is concerned with activities that relate to deploying Big Data in combination with other organisational and managerial processes. A common theme that emerged from the literature reviewed in Chapter 2 is that capabilities in operation may be represented by different coordinated organisational and management processes with a strong grounding in organisational routines such as learning (Teece et al., 1997; Eisenhardt and Martin, 2000; Wang and Ahmad, 2007; Ambrosini and Bowman, 2009; Easterby-Smith et al., 2009). Teece et al (1997, p. 518) suggest that organisational and managerial processes may describe, '*the way things are done in the firm, incorporating patterns of current practice and learning in the form of routines'*. Winter (2002, p. 343) further confirms this suggestion and adds that a learned and stable pattern of collective activity through which the organisation systematically generates and modifies its operational routines reflects decision-making during the production of significant outputs (capabilities) of a particular type.

By synthesising these views, it can be argued that processes not only have a patterned element which can be described by routines, but can also embody management activities, such as managerial decision-making. For example, research has identified the critical role managers' activities play in the advocacy of dynamic capabilities through the provision of new deployed resources (Helfat et al., 2007; Teece, 2012; Ambrosini et al., 2009; Braganza et al., 2017). From this view, it is assumed that managerial activities in deploying Big Data initiatives, based on managers' perceptions, abilities and choices, will have a profound impact on how Big Data capabilities are identified and developed in an organisation. Thus, it can be summarised that in general processes are the collections of routine and non-routine activities by which capabilities are put into practice. Consequently, developing understanding of Big Data initiatives and the required capabilities development process will require an examination of those organisational and managerial routine and/or non-routine activities. However, there is less insight in the literature about how to structure and leverage these activities, particularly those which relate to Big Data initiatives.

This research is effectively a response to calls by various international scholars for more research on Big Data initiatives and required capabilities development, given their growing importance in individual industries and in the overall global economy (e.g. Brynjolfsson et al., 2011; McAfee et al., 2012; Wamba et al., 2015; Braganza et al., 2017; Mikalef et al., 2017). As an example, Brynjolfsson et al. (2011) found that there is a limited body of knowledge on the organisational capabilities that Big Data exploitation encompasses, and how such capabilities can be developed to gain full benefit. Moreover, Braganza et al. (2017) found that the extent to which Big Data initiatives are grounded in theory is little addressed in the literature. The authors encourage an expansion in the scope for examining Big Data initiatives through a variety of theoretical lenses.

Motivated by the recent increase in academic and practical/managerial interest in Big Data and the associated phenomenon of developing required capabilities, the aim of this research is to identify how Big Data initiatives are currently managed and implemented in order to drive innovation, in particular in the pharmaceutical industry. Accordingly, the main academic objective was to explore Big Data initiatives, preparation for their adoption, and the required capabilities development processes in a particular pharmaceutical company.

Adopting the Resource-Based View (RBV) and Dynamic Capability (DC) perspective (see Chapter 2 and Chapter 3) as a way to observe the Big Data phenomenon, and as a means of exploring processes, activities, and practices through which Big Data initiatives arise in a global pharmaceutical company, the purpose of this study is to contribute to the existing knowledge, literature, and practice of Big Data initiatives and the required capabilities domain research area. To achieve this, an investigation is needed into how pharmaceutical companies perceive Big Data and what capabilities they employ to integrate it within their company strategy.

Big Data as an intangible strategic resource for an organisation is conceptualised in the Resource-Based View (RBV) theory while the Dynamic Capabilities (DC) theory is used to reflect the dynamism of the digital environment and to conceptualise the capabilities development process for Big Data. Each theory overcomes some limitations of the other (see Chapter 2 and Chapter 3) and provides the researcher with a comprehensive understanding of the phenomena under investigation.

It has been argued that the Dynamic Capability perspective is well-suited to the study of various types of innovation processes (Teece et al., 1997; Makadok, 2001; Bhatt and Grover, 2005; Teece, 2017). Conceptual links between Big Data initiatives and Dynamic Capabilities have been made by different authors (e.g. Teece, 2007; Wamba, 2016; Akter and Wamba, 2016; Braganza et al., 2017) and theoretical development of the Dynamic Capability concept has advanced rapidly in the last decade. Accordingly, there has been a call for the dynamic capabilities development process to be applied to the domain of Big Data. Moreover, authors such as Easterby-Smith et al. (2009), Ambrosini and Bowman (2009, p. 46), and Teece (2012) argue that the field is dominated by favour of quantitative approaches, and they propose to investigate it by using fine-grained qualitative studies to understand '*the details of how dynamic capabilities are deployed*.' Easterby-Smith et al (2009, p. 6) further suggests that such qualitative studies might provide '*detailed descriptions of what processes are involved, the role of management, the reconfiguration of the dynamic capabilities, and the interaction with the environment'*. Teece (2012, p. 1400) and Danneels (2010) add that although dynamic capabilities, in particular managerial dynamic capabilities, has been traced by using large data sets (e.g. Adner and Helfat, 2003), they can best be analysed through in-depth qualitative research. As the empirical literature is still at an early stage, and as the research paradigm of dynamic capabilities is still relatively new, the author believe that illuminating case studies are likely to provide powerful insights. To the best of the researcher's knowledge, no study to date has adopted these suggested approaches and empirically explored how the preparation and required capabilities development for Big data initiatives come about in MNC in the pharmaceutical industry.

By conducting a qualitative in-depth investigation of a global pharmaceutical company which is engaged with Big Data preparation and adoption activities (the case study) this research responds to the above call and makes a contribution to the enhancement and generation of new knowledge on the process of capabilities development for Big Data initiatives within the global pharmaceutical company. It also draws on the theoretical rationale and gaps in the existing literature that are expounded in the literature review in Chapter 2.

The next section clarifies the research questions and the aims and objectives of this research.

## 1.3 The Research Aim, Objectives and Questions

The lack of empirical studies on the organisational capabilities (operational and dynamic) relating to Big Data initiatives that global pharmaceutical companies deploy in response to digital change presents the main research gap that this study attempts to fill. By addressing this gap the research would also incorporate an explanation of how Big Data initiatives and required capabilities are identified and developed in practice.

More specifically, to address the gaps and weaknesses identified in the literature review (see Chapter 2), the following aim and objectives represent the considerations that the researcher addresses in relation to the research questions.

### *1.3.1 The Research Aim*

The primary aim of the research is to gather, examine, and explore the evidence reflecting how Big Data initiatives and required capabilities come about in MNC in the pharmaceutical industry and to make an assessment of the implications that arise from this.

### *1.3.2 The Research Objectives*

Deriving from the research aim stated above and the theoretical rationale that is expounded in Chapter 2 and Chapter 3, the key objectives of the research are outlined as below.

**1.** Conduct a comprehensive literature review of Big Data and Dynamic Capabilities (DC), covering the Information Management, Strategic Management, Marketing, and Big Data Management journals. This will be used to:

   I. Clarify the theoretical underpinnings adopted in the thesis.

   II. Explore related literature on Big Data initiatives and the required capabilities development process, with RBV and DC being used to identify the research gaps.

   III. Justify the methodological approach of this thesis.

   IV. Develop the contribution to knowledge and literature.

**2.** At the empirical stage:

   I. Investigate and explore those processes which persuaded the company to start Big Data initiatives. The main goal for this stage is to observe existing organisational resources and competencies/capabilities in order to find ways in which companies achieve progress with their Big Data initiatives development.

II. Examine and explore those processes that enable the company to adopt Big Data practices effectively. In this respect, the study has investigated capabilities (operational and dynamic) that are related to a successful Big Data initiatives adoption.

### *1.3.3 The Research Questions*

To fulfil the aim and the objectives outlined above, the following questions have been formulated to guide the execution of this study.

1. **Why did an MNC in the pharmaceutical industry prepare for Big Data adoption? RQ1**

And

2. **How did the company approach the issue of using Big Data and how did they identify and develop their capabilities for Big Data? RQ2**

   **I. What new capabilities did they develop?**

   **II. How did they develop these capabilities?**

## 1.4 The Methodological Approach

To guide the research, and address the research questions which underpin it, the study has been rooted within the Critical Realism (CR) tradition, employing a qualitative case-study approach. As suggested by Maxwell (2005), the research design should incorporate considerations from the current literature (among other factors). The chosen approach is therefore generally considered a sensible strategy for research in its response to calls for more qualitative research in the field of Big Data and capabilities/dynamic capabilities as outlined in Chapter 2.

Furthermore, Yin (2003) suggests that when a specific topic has not been fully investigated and there is a limited body of knowledge surrounding it, such as the study's domains (Big Data initiatives and required capabilities development) a deep examination of the precise context in which it occurs can deliver insight and contribute to knowledge. Therefore, taking a single case study approach that allows the researcher to conduct an in-depth examination into a particular capabilities development process for Big Data initiatives has been considered an appropriate choice of methods for conducting this research.

The research strategy was executed in fieldwork in Switzerland and US at the case study company's headquarters. The fieldwork extended over a period of six months for the data collection (and preliminary analysis). The findings and conclusions were derived from a thematic analysis method in which the NVivo 11 tool (Chapter 4) was used to analyse the data.

## 1.5 The Study's Contribution to Knowledge

Overall, the main contribution of this study is a model of the organisational process in Big Data adoption and the deployment of required capabilities (Chapter 5, Figure 5.4). The model was at first based on the conceptual framework laid out in the literature (see Chapter 3) prior to the data collection stage, and then developed using the empirical findings of this study.

I. By describing the adoption of the new resource Big Data and the capabilities development processes (with associated organisational and managerial activities such as: strategic competitive response, learning, reconfiguration, and coordination) the model establishes their effect on the company's existing operational and new capabilities development for Big Data. Although the notion of enhancing existing capabilities had been acknowledged to close gaps or improve underperforming capabilities (Lavie, 2006; Danneels, 2010), the role of dynamic capabilities in this process had received less attention in the literature. Furthermore, some scholars are still sceptical about the role of dynamic capabilities (Winter, 2003; Zahra et al., 2006). Thus, findings from this study shed light between capabilities development and dynamic capabilities research by explicating the role of dynamic capability in the Big Data capabilities development process. In particular, the study provides an empirical support for the underlying assumption of the role of dynamic capability in modifying operational capabilities and developing new capabilities for Big Data (Winter, 2003; Helfat and Peteraf, 2003; O Reilly and Tushmann, 2008, p.186; Pavlou and El Sawy, 2011). By doing so, this study seeks to add insight to the existing research and thereby overcome a criticism of dynamic capability – of it being established only at an abstract level of description, and lacking empirical grounding (Wiliamson, 1999) and being tautological in nature (Priem and Butler, 2001; Erikisson, 2013).

II. Beyond confirming that dynamic capabilities such as strategic competitive response, reconfiguration, coordination, and learning are enablers for the creation and implementation of Big Data initiatives (Teece, 2007; Protogerou et al., 2011; Erevelles et al., 2015; Wamba, 2016) this study also illustrates what the additional activities and practices were, such as: support from senior managers, networking and partnership, and cultural transformation and how they were enacted. Thus, the study also contributes to the contextual approach of the dynamic perspective, more specifically to the existing literature (Teece, et al., 1997; Zahra, et al., 2006; Tripsas and Gavetti, 2000; Adner and Helfat, 2003; Teece, 2007; Eggers and Kaplan, 2009) related to the understanding of the role of senior management in capabilities development. As will be seen, senior management does indeed play a vital role within the process (Braganza et al., 2017) and their ability/skills (Gupta and George, 2016) and active participation are regarded as necessary success factors for Big Data capabilities development. The underlying importance of management is in line with propositions of the dynamic capabilities paradigm, in which entrepreneurial managers play a vital role in identifying opportunities and the need for change, and in formulating responses and implementing a course of action (Helfat et al.,2007; Teece, 2012). Although some elements of dynamic capabilities may be embedded in the organisation, the capability for evaluating and implementing changes to the configuration of assets (both within and external to the organisation) rests on the shoulders of senior management (Teece, 2012). Thus, the empirical evidence illustrated how purposeful practices and decisions at the senior management level influenced the development of required capabilities for Big Data that is unlikely to have happened without those '*managerially-amenable'* practices (Pavlou and El Sway, 2011, p. 260). Thus, the findings of this study add insight to the existing literature (Gunther et al., 2017; Braganza et al., 2017) by confirming the importance of managers' abilities/practices for implementation of Big Data initiatives and developing required capabilities.

III. The study brings an understanding of dynamic capability development for Big Data initiatives and highlights the role of networking and partnership during this process. The empirical evidence provides insight into tangible means for managers, by which managers in this process enhance their company's dynamic capabilities through networking and partnership. This was challenged by the Winter (2003, p. 991) who points out that there is doubt that deliberate efforts to strengthen dynamic capabilities represent a genuine option for managers. This is mainly because Winter (2003, p. 993) believes that a forceful search for such instances can impose additional cost. Winter believes that the capability must be exercised: to have dynamic capabilities and no occasion for change is merrily to a carry an additional cost. However in the case of a fast-moving, competitive Big Data environment that requires continuous modification and, if necessary, a complete overhaul to maintain a good fit (Teece, 2012), with the ecosystem in which an organisation operates, there is an enhanced need for strengthening dynamic capabilities – this is especially true when an innovating organisation needs to pioneer new ways of adopting Big Data practices. This study provides empirical/practical evidence that managers interested in creating knowledge about a new resource through networking and partnership practice help in enhancing dynamic capabilities. This finding complements the conventional approaches to strategy that suggest that in Big Data programmes many roles are played by outside organisations (Braganza et al., 2017) and that the nature of relationships are more transitory. Interaction between multiple factors such as partnership, networking, and collaboration with different parties enhance and strengthen the company's seizing and reconfiguration abilities at the preparation stage. Thus, these activities can be interpreted as knowledge creation, knowledge acquisition, and knowledge dissemination which can be dynamically used to fine-tune Big Data initiatives and to formulate responses or transformation activities to face this kind of challenges when there is little experience to call upon, and no best practices yet established.

## 1.6 Outline of The Thesis

This thesis contains seven chapters as outlined below.

**Chapter One** introduces the background, the motivation, and the importance of the research, along with the research aim, objectives, and the research questions guiding the investigation. The chapter also highlights the methodological approach for the study and the study's main contribution to knowledge.

**Chapter Two** provides a comprehensive review of relevant literature, from which research gaps have been identified, some of which are addressed in this research. The chapter further assists in positioning the theoretical underpinnings of the research that is summarised in Chapter 3.

**Chapter Three** introduces the conceptual framework of the study that has been developed based on the literature review, prior to the data collection stage.

**Chapter Four** describes the methodology guiding the conduct of this study, including its philosophical standpoint, along with the methods used to collect and analyse data. The chapter also provides discussion concerning the rationale behind the methodological choices and explains the data analysis process used in this thesis.

**Chapter Five** presents the findings of the case study. These findings are presented in two parts based on the Global (US) and EMEA sites of the company preparing for the Big Data adoption.

**Chapter Six** demonstrates the research results and their contributions to knowledge.

**Chapter Seven** provides a concluding summary for this thesis along with the research limitations, and the theoretical and managerial implications, and offers recommendations for further research.

# Chapter 2: Literature Review

## 2.1 Introduction

This chapter synthesises the existing literature in the field of strategic management research, and the Information System (Big Data, RBV and capabilities/dynamic capabilities) that lays the theoretical and conceptual foundation for the investigation of this research. Furthermore, by reviewing Big Data initiatives and required capabilities development along with related challenges and opportunities, the chapter develops the argument on which this thesis is based by appraising gaps and weaknesses in the existing literature, some of which are addressed in this research. The first section (2.2) begins by looking at what is understood as 'Big Data' and explains commonly accepted definitions, views, and related business opportunities. The second section (2.3) reviews the Resource-Based View (RBV) along with the interpretation of Big Data from the perspective of the RBV theory adopted in this study. The third section (2.4) discusses the Dynamic Capability (DC) theory that has also been adopted to examine the research problem. The next section (2.5) discusses Big Data-related challenges and the required capabilities needed to overcome some of those challenges. The fifth section (2.6) reviews capabilities and dynamic capabilities for big data in pharmaceutical industry, while the sixth section (2.7) identifies research gaps. Section (2.8) provides a concluding summary of the literature review chapter.

## 2.2 Big Data and Related Opportunities

The increasing amount of digitally sourced data that is generated around us, and the advanced analytic tools that drive many industries to change their practices in order to make sense of this data, have in combination become one of the important topics for academics and practitioners in the coming years. From a business perspective it has been estimated by the International Data Corporation (IDC) that the global data volume will grow from 130 exabytes to 40,000 exabytes from 2005 to 2020 (Gantz and Reinsel, 2012, p. 16). It has likewise been predicted that there will be an increase in demand in the adoption and implementation of Big Data initiatives. Figure 2.1 below illustrates the growing demand of Big Data measured in ZB developed by Ghosh (2015)

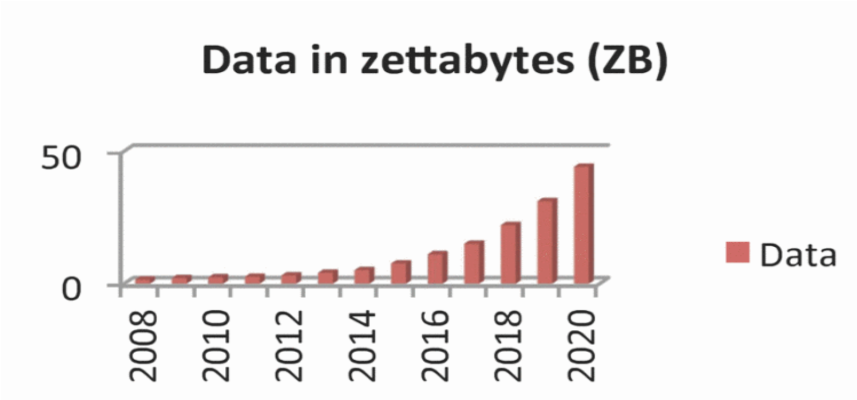



*Figure 2.1: Growing Demand of Big Data Measured in ZB (Source: Ghosh, 2015)*

From an academic perspective, the research on Big Data is also rapidly developing and becoming prominent in many research domains, such as science, technology, economics, and social sciences, as well as in the business domain. However, while the interest in Big Data is increasing, there is no uniform definition of this new asset. One of the earliest definitions of the term Big Data comes from information technology research company Gartner, who in 2001 defined it as '*challenges and opportunities in data growth*'. Doug Laney defined these *challenges and opportunities in data growth* as having three aspects: increasing volume, increasing velocity, and increasing variety (Laney, 2001). Later Manyika et al (2011, p. 1) defined Big Data as '*datasets whose size is beyond the ability of typical database software tools to capture, store, manage, and analyse'*. Similarly, Kaisler et al. (2013) defined it as '*the amount of data just beyond technology's capability to store, manage, and process efficiently*'. With these definitions the authors highlight the challenges which accompany Big Data. In particular, with more data being generated, it has become difficult for traditional architectures and infrastructures to process these amounts of data within an acceptable time-scale. Thus, Big

Data challenges the capability and compatibility of existing resources to handle it in ways that achieve the desired objectives (Chong and Shi, 2015).

Big Data may be relatively new for online firms (Google, LinkedIn, Amazon) but many other large firms have already been struggling with it for some time (Davenport, 2012). Numerous companies have been using large databases and analytics for the last couple of decades (Galbraith, 2014; Akter and Wamba, 2016). For example, in some cases transactions are stored in data warehouses and analysed with data-mining algorithms in order to extract insights. However, in the past this data was mainly derived from transactions and was highly structured in format (Bharadwaj et al., 2013, Chen et al., 2014). Credit card companies, for instance, stored all of their transactions in a database and analysed them with fraud-detecting algorithms. What is new today is the increased accessibility of digital data from various sources (e.g. mobile phones, GPS devices, video from surveillance cameras, audio from call centres, e-mails, tweets, text messages etc.) along with the ability of database software tools to capture, store, manage, and analyse it in real-time (Manyika, et al., 2011; Davenport, 2012; Bharadwaj et al., 2013; Galbraith, 2014). Many companies have realised that the data they own or have access to, and the way they use it, can differentiate them from their competitors. Furthermore, it can even provide them with a competitive edge (Davenport, 2012). These developments suggest that Big Data is still an evolving phenomenon that is seen to be the next frontier for innovation, competition, and productivity, or the next management revolution (McAfee and Brynjolfsson, 2012; Buhl, et al., 2013; Gobble, et al., 2013; Gandomi, et al., 2014).

Size and availability are defining characteristics of Big Data. Data volume alone, however, is not its most novel characteristic (Boyd and Crawford, 2012). Closely associated with large data volumes is the variety of such data, the frequency with which it is updated, the speed by which it grows, and its privacy and quality issues (Davenport, 2012). The key features of Big Data identified by Gantz and Reinsel (2012, p. 910) - Volume, Variety, Velocity and Veracity - have been widely accepted as the '4Vs', or the four key attributes of Big Data.

However, recently much attention has been placed on the value (in economic terms) of this data for companies. Discussion (IBM, 2014) about the opportunities and challenges of Big Data now have centred on the five Vs: Volume, Variety, Veracity, Velocity and Value. Much of the debate about what Big Data developments offer to research and practice has concentrated on these dimensions. Thus, the concept of Big Data has attracted vast attention because of its great potential in impacting businesses (Chen et al., 2012; George et al., 2014). Increased amounts of new and different types of data are believed to have the potential to develop new business ecosystems, and to coordinate networks of companies, devices, and consumers that create value (Weill and Woerner, 2013).

### *2.2.1 Application of Big Data for Business*

Recently, a significant body of the research has been directed to identify the opportunities and value that Big Data offers to businesses. It has been argued that Big Data has an open-ended potential, to be explored in a variety of ways and to different ends (Boyd and Crawford, 2012; Davenport, 2012; Chen et al., 2014). For instance, McAfee and Brynjolfsson (2012) and Chen et al. (2014) underline the opportunities that Big Data creates with respect to improving specific activities, such as customer relationship management. These authors suggest that immediate processing of real-time data should be included in decision-making as part of real-time applications, as such rapid insights can provide a competitive advantage for businesses. Furthermore, empirical research also confirms the advantages of data-driven decision-making and has identified a positive association with firm performance (LaValle et al., 2011; Wamba et al., 2016). For example, Kwon et al. (2014) and Ghosh (2015) highlight the positive role of Big Data in managing logistics and supply chain management. In particular, the authors describe how insights generated from Big Data could play a critical role on the different decisions related to supply chain and logistics operations of the business. Thus, the authors confirm that real-time customer feedback makes it possible to monitor and understand the areas where a product or service is failing.

Aaltonen and Tempini (2014) investigated the opportunities Big Data offers for the development of new products and services and highlighted that the data pool can be a comprehensive collection of user behaviours. In particular the authors looked at how a telecommunications operator transforms data from a network into valuable information about a new kind of advertising audience. In traditional media, this was achieved by distributing separate measurement devices to a small subset of consumers. This collected data therefore consisted of carefully planned samples gathered for predefined purposes, whereas in the present digital ecosystem the behaviour of the entire user base can be captured implicitly. Aaltonen and Tempini (2014) state that such a data pool offers the possibility for a company to create new kinds of products and services with which the company can compete against businesses who rely on more traditional methods. This argument was later supported by the findings of Woerner and Wixom's (2015), who demonstrated that use of sensors in products to track actual product usage and the mining of social media to discern for customer sentiment, and to understand customer preferences and behaviour, afforded end consumer visibility to manufacturers. This had previously been impossible; for decades, manufactures had relied on trade partners to feed data into their internal product development and customer-focused processes (Woerner and Wixom, 2015).

Moreover, is has been argued (Varian, 2010; Woerner and Wixom, 2015) that Big Data facilitates improvements to business models across different industries. Big Data in particular permits the formation of new insights, allowing the resulting decisions to be made not only faster (Aaltonen and Tempini, 2014) but also more precisely (Davenport et al., 2012). For example, Varian (2010) highlights that because transactions are now computer-mediated, it is possible to observe behaviour that was previously unobservable, enabling the development of new business models. The author offers the examples of Uber (transport service) and Air BnB (hospitality service) as examples of such data-driven business model innovations. Similarly, Woerner and Wixom (2015) present interesting examples of media companies such as Netflix and NBC Universal, who overruled the traditional business model and moved to data-driven content. NBC Universal now make changes to television programming in response to real-time customer sentiment. Within the span of just a few hours - or less - the company can respond to feedback from particular market segments, even unanticipated ones. In particular, when the company moved a popular show to a later time slot, the change was negatively received by families whose children could not stay up late enough to watch the series. The company was able to response within minutes, and the show was moved to earlier in the day. This type of change would previously have taken weeks (Woerner and Wixom, 2015).

From a marketing perspective, Pauwels et al. (2009) and Jarvinen et al. (2012) argue that the availability of Big Data creates two major opportunities: Firstly, firms have access to an enormous range of digital tools which can be utilised for marketing purposes; secondly, the digital environment has made marketing more measurable by improving the ability of marketers to assess, collect, process, and report data on marketing activities. Online retailers such as Amazon and eBay are good examples of businesses successfully using Big Data for a range of marketing purposes (Wamba, et al., 2016; Davenport, 2014). Financial institutions who had previously relied on a customer's financial history to arrive at a credit score can now use Big Data for their marketing activities. External data sources, such as for example social networking websites, allow them to collect customers' non-financial information, such as university affiliation, club memberships, and social activities to build more complete and accurate credit-rating models (Zhao et al., 2014).

Table 2.1 below summarises the alternative definitions of Big Data, and lists the opportunities, value, and challenges that Big Data offers to different business domains and industries, as discussed above and identified in the literature. (The challenges presented by Big Data will be discussed in greater detail later in this chapter.)

| **Authors, Date** | **Definition/Opportunities** | **Challenges** | **Strategic and Organisational Impacts / The Value of Big Data To Organisations** |
|---|---|---|---|
| Laney, 2001 | Large volumes of extensively varied data that are generated, captured, and proceed at high velocity. | Processing the data with existing architectures | Developing innovative insight, products, and services |
| La Valle et al., 2011 | Massive amounts of information | - Lack of understanding of how to use data analytics to improve the business<br>- Lack of executive sponsorship<br>- Limited ability to capture, aggregate, analyse or share insights | - Sharper and more timely insight, operation, and production<br>-Marketing and sales<br>-Financial management |
| Manyika et al., 2011 | Data sets whose size are beyond the ability of typical database software tools to capture, store, manage, and analyse | - Capture<br>- Storage and management<br>- Analysis | Discovery of new insights into products, processes, customers, markets, and competitors |
| McAfee and Brynjolfsson, 2012 | - A management revolution<br>- Advanced stage of digitization | - Leadership teams<br>- Talent management<br>- Technology<br>- Date "noise" | - Evidence-based decision-making / data-driven decisions<br>- Competitive advantage<br>- Customer relationship management |
| Davenport et al., 2012 | An expanding sea of data that is either too voluminous or too unstructured to be managed and analysed with the existing systems | - Shortage of analytical skills<br>- Data storage<br>- Data-driven culture | - More efficient and effective operations<br>- Optimisation of supply chain flows<br>- Setting the most profitable price for products and services |
| Chen et al., 2012 | Large volumes of unstructured data. | – Processes<br>– Governance | - Minimizing errors and quality problems<br>- Improving customer relationships<br>- Better understanding of business and markets |
| Boyd and Crawford, 2012 | Cultural, technological, and scholarly phenomenon, that rests on the interplay of technology, analysis, and methodology | - Management<br>- Quality<br>- Privacy | - Novel business models |

| | | | |
|---|---|---|---|
| Sharma et al., 2012/2014 | A vast amount of structured and unstructured data from a variety of sources | - Understanding the insight generation process<br>- Communicating insights to business units<br>- Centralized structures potentially limit communication with and the involvement of different business stakeholders in Big Data projects | - Enhanced decision-making |
| George et al., 2014 | 'Ever-increasing volumes of data, often in tera or petabytes worth of storage capacity' | - Powerful computational techniques<br>- Sharing, privacy, and ethics | - Narrowing information and time gap<br>- Granual information about customers |
| Aaltonen and Tempini, 2014 | The sheer amount of data. The massive amount of data generated by the digital infrastructure. | - The technological capacity required to simultaneously filter the sheer amount of data | - Ability to target different customers<br>- Interacting with customers in different ways<br>- Open-ended potential, to be explored in a variety of ways and to different ends |
| Agarwal and Dhal, 2014 | Readily available large and complex data sets.<br><br>'Sheer size and variety in Variables' | - Making sense of heterogeneous and fragmented information<br><br>- Data Networks | - Ability to conduct large-scale experiments on social phenomena<br>- Ability to communicate with the larger community of scientists and businesses |
| Morabito, 2015 | Big Data is data that exceeds the processing capacity of conventional database systems. The data is too big, moves too fast, or does not fit structured database architecture. | - Comparable architecture<br>- Complexity | - Marketing services |
| Constantiou and Kallinikos, 2015 | Large data volumes generated and made available on the Internet and the current digital media ecosystems | Much of Big Data, while seemingly valuable, does not fit into the recording, measurement, and assessment systems that enterprises have built up to aid decision- making. | - More informed strategising<br>- Information-based products |
| Woerner and Wixom, 2015 | Big Data can enable companies to transform in ways that propel them into new industries or ecosystems and alters traditional competitive landscapes | - Uneven distribution of Big Data throughout the organisation<br>- Consolidating and simplifying the increasing amounts of data that result from digitization | - Improved business model<br>- Optimized business processes<br>- Decision-making<br>- End consumer visibility |
| Abbasi et al., 2016 | One can separate Big Data and 'regular-sized' data based on the presence of a set of characteristics commonly referred to as the four Vs: volume, variety, velocity, and veracity | -Storage and management<br>- Distributed storage architectures capable of handling large quantities of unstructured data<br>- Data quality and credibility | - Key resource of organizations' business models<br>- Data-driven business models<br>- Support self-service and real-time decision making. |

| | | | |
|---|---|---|---|
| Gunther et al., 2017 | Large volumes of extensively varied data | - Data access<br>- Dealing with stakeholder interests such as ethical concerns and regulation<br>- Lack of quality | -Discovering new and useful insights about products, processes, customers, markets, and competitors |
| Braganza et al., 2017 | 'Big Data is that data is an asset. As with other assets, data can be used to improve competitiveness, innovation, and efficiencies in organisations' | - No apparent business process for Big Data initiatives<br>- Required resources are often outside the organisation | - Big Data has the potential to increase economic returns by offering deeper insights from the oceans of data available<br>- Big Data has led to the creation of new technologies, methods, data capture applications, visualization techniques, and data aggregation capabilities |

*Table 2.1: Big Data Opportunities, Challenges, and Value for the Business (Author's own)*

As can be concluded from this summary of the opportunities and potential for creating value for businesses presented by Big Data, it has been increasingly seen as a strategic new asset capable of changing competition by transforming organisational processes with new organisational capabilities (McAfee and Brynjolfsson, 2011; Davenport, 2012; Kumar et al., 2013; Kwon et al., 2014). However, as can also be discerned from the above table and the prior discussion, Big Data refers to enormous amounts of data that can no longer be managed by traditional approaches. The volume and velocity of such high-dimensional data requires new Big Data capabilities, where existing capabilities are of no use. Although initial discussions about the phenomenon in both the academic and practitioner literature are characterised by opportunities (Clarke, 2016), Big Data optimism and the expectation of benefits on their own do not guarantee the gain of actual value. There is a need to investigate how organisations prepare themselves to start Big Data initiatives and how they translate, as well as fail to translate, its potential into actual social and economic value. Consequently, there is tremendous interest in academia and industry to address the challenges and to increase the knowledge which surrounds this phenomenon.

#### *2.2.1.1 Big Data Adoption in Big Companies*

The adoption of Big Data is a complex process that includes data collection, management, storage, analysis, mining, and application (Chong and Shi, 2015; Wamba et al., 2016; Yaqoob et al., 2016), which is further complicated by the volumes of data involved, its variety, and the rate at which it can be processed. There are many acknowledged requirements for the adoption of Big Data such as: well-developed IT infrastructure, the talents of specialist Big Data analysts, and special analytical tools to address technical challenges (Gandomi and Haider, 2015). For example, Wamba et al. (2015) suggest that organisations need to leverage the information eco-system arising out of the adoption of Big Data to share real-time information, better understand customers, optimise the supply chain, and develop insights for decision making. Davenport (2014) highlighted the importance of Big Data technologies, such as Hadoop or Natural Languages Processes, to analyse huge amounts of data for cost- reduction purposes, to make faster and better decisions, and to improve the products and services being offered. Yaqoob et al. (2016) believes that only advanced data-mining and storage techniques can make Big Data adoption possible. Together with IT Infrastructure, Brinkhues et al. (2015) pointed out additional factors such as data resources, financial support, and the cost of Big Data adoption. Likewise, looking at Chinese enterprises, Cheng and Li (2016) proposed factors concerning Big Data adoption such as: data talent, technical ability, organisational culture, organisational structure, and data policies. Akhtar et al. (2018) suggest bundling different Big Data skills in teams and specific managerial actions. Teams depend on multi-disciplinary skills (e.g. computing, mathematics, statistics, machine learning and business domain knowledge) help to turn traditional business operations into modern data-driven insights (e.g. knowing real-time price changes and customer preferences) and leading to specific Big Data actions that enhance Big Data adoption.

However, as argued by McAfee and Brynjolfsson (2012), as with any new business tool, adopting Big Data necessitates change throughout an organisation. Those businesses that have been the most successful with their Big Data deployments are those that have embraced these changes, transforming their organisations so that the insights gained through Big Data analysis can actually make a difference by becoming actionable (McAfee and Brynjolfsson, 2012; Davenport, 2013; Wamba et al., 2016). For that to happen, leaders must be willing to invest significant amounts of time and energy to make sure that all managers across the organisation are fully aligned with the company's Big Data mission, as well as being aware of the existence of the risks inherent in the adoption of new technological solutions (Grover et al., 2018). In addition, for some companies the biggest challenge in deploying Big Data may not be the technology but how to leverage human capital and organisational culture to support the Big Data adoption strategy and entailed operational activities. Looking at Big Data adoption in big companies, Davenport (2013) relates the story of Walmart's successful adoption of Big Data. Walmart is one of the largest retailers in the world and the world's largest company by revenue, with more than two million employees and 20,000 stores in 28 countries, and is living evidence that adopting a Big Data-driven approach - in particular the timely analysis of real-time data - is key to driving business performance. Walmart collects 2.5 petabytes of data from 1 million customers every hour. In 2012, the company upgraded the processing capacity and speed of their Big Data systems, from a *10-node Hadoop cluster* to a *250-node Hadoop cluster* so that all the unstructured data generated at 10 different websites could be combined and collected into a *new Hadoop cluster*. Since then, the organisation has been accelerating Big Data adoption to provide the best e-commerce technologies with the motive being to both deliver the best customer shopping experience and to improve its operational efficiency. In addition to Hadoop the company use *NOSQL technologies* to provide internal customers with access to real-time, centralised data collected from different sources. In doing so the company creates the world's largest private *Cloud* and *analytics hub*, known as *Data Cafe*, which pulls information from 200 diverse sources. The Data Cafe system has led to a reduction in the time it takes from a problem being spotted to a solution being proposed from an average of two to three weeks down to around 20 minutes (Davenport, 2013).

eBay is another good example of a company that has adopted Big Data successfully. One of the keys to eBay's success is its ability to turn its Big Data, more than 250 terabytes (TBs) in volume and high streaming data velocity with 6 billion writes and 5 billion reads generated daily, into useful business insights that benefit its customers directly. eBay has invested in *DataStax Enterprise* with integrated search and real-time Big Data analytics deployed across multidata centres. With substantial data access and analysis capabilities in place, eBay emphasises customisation to enhance its customers' digital experience in order to drive sales and satisfaction. In doing so, eBay demonstrates the effect of data Value on its assets, its capabilities, and the multiple mechanisms by which it targets consumers and generates strategic impact on both financial growth and its reputation for industry leadership (Davenport, 2013).

In summary, with so many new technologies and processes, and with so much more information to take into account, organisations and leaders need to revamp their current strategies to take advantage of the benefits that Big Data has to offer. However, despite increasing awareness (examples discussed above, successful case studies, and best practise available online) that may enable enterprises to consider all the factors that may affect the adoption of Big Data, many companies have little or no knowledge of the concept or use of Big Data. Moreover, there are still limited numbers of empirical studies about how organisations can re-equip, reconfigure, or develop capabilities for the successful adoption of Big Data.

### *2.2.2 Big Data in Pharmaceutical Industry*

#### *2.2.2.1 Background of Pharmaceutical Sector Development*

Since 1980 the healthcare industry, in particular the pharmaceutical segment of the industry which is the core of this study, has started integrating modern biotechnology in their research, production, and marketing activities (Taylor, 2015). Modern biotechnology refers to a set of techniques that involve manipulation or change of the genetic patrimony of living organisms (Ramani, 2000). Advances in modern biotechnology have triggered a radical change in the nature of the research processes used in the development of new drugs (e.g. creation rational methods, genomics, which refer to structure and functions of genes, and randomized design). The randomized controlled trial (RCT) is a powerful tool that has provided the evidence-based decision for many of the advances of modern medicine (Harvey et al., 2012). Thus, the use of genomics and new tools in the pharmaceutical sector has revolutionised approaches to drug safety, moving from detection and enumeration to prediction (Woodcock, 2007). They have also led to incremental product (drug development) innovations and reduced inefficiency in the production of a number of pharmaceutical products (Ramani, 2000). Therefore, biotechnology has an increasing influence on the evolution of the global pharmaceutical industry. Moreover, support from the U.S. Food and Drug Administration (FDA) which is charged with implementing policies that ensure that the benefits of new products will outweigh their risks, while simultaneously promoting innovations that can improve health, helped push forward the pharmaceutical industry's market capitalisation above US $1 trillion (Ernst and Young, 2014).

As has been mentioned earlier in this thesis (Chapter 1) the modern pharmaceutical industry is dominated by a few large MNC pharmaceutical companies, known as a 'Big Pharma' (Chandler, 2009; Hedner, 2012). Through Big Pharma's integrated approach of exploiting the kinds of scientific and technological advances mentioned above, Europe and the US led the success of the modern pharmaceutical industry. These companies acquired biotechnology capabilities that led to the discovery and development of small molecule and biological drugs, as well as large-scale clinical trials management, management of regulatory approvals, and in the marketing and distribution of pharmaceuticals around the globe (Sadat et al., 2014).

Despite the advances discussed above, drug development programs are still expensive and usually require many clinical studies and patient exposures (Groves, 2013). Even with increasing investment in pharmaceutical research and development, successful development of novel drugs is slowing, and drug development costs per successful entry have increased, particularly the costs of clinical trials (Woodcock, 2007; Feldman et al., 2012). Moreover, there is still a great deal of uncertainty about the performance of drugs that are new to the market (Sadat et al., 2014). In addition, data from long-term use are usually limited (Woodcock and Woosley, 2008). Figure 2.2 illustrates a comparison of global pharmaceutical industry investment in research and development with the global output of new molecular entities.

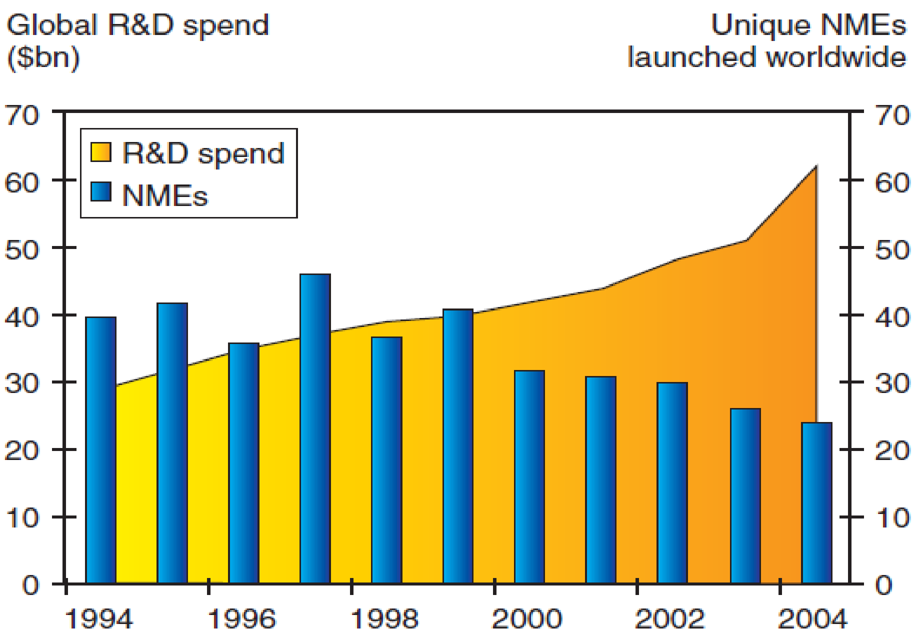



*Figure 2.2: Comparison of Global Pharmaceutical Industry Research and Development Investment Versus Global Output (Source: Woodcock and Woosley, 2008)*

Traditionally, regulatory approval of a new drug based on its safety and efficiency has been the biggest barrier to its market entry (Sadat et al., 2014). However, recently the biggest challenge for a new drug's success is whether it would qualify for reimbursement from the payers (Ernst and Young, 2014). Indeed the payers are increasingly becoming important in determining the value of new drugs. To better demonstrate the effectiveness and value of new drugs to regulators and payers, Big Pharma is focusing on the development of personalised medicines that work on a specific patient subgroup who express a particular disease characteristic (Burrill, 2013). Personalised medicine promises prediction, prevention, and treatments that are targeted to individuals' needs (Harvey et al., 2012). Moreover, Big Pharma is also building innovative healthcare delivery models in many emerging markets, by engaging doctors, patients, and policy-maker stakeholders in various healthcare initiatives. These include raising awareness among patients through patient education programs (Ernst and Young, 2014).

#### *2.2.2.2 Big Data Potential in Big Pharma*

Accompanying the shift in the pharmaceutical industry discussed above, the emergence of Big Data and technologies such as social media, smartphone apps, wirelessly connected devices, and sensors have become new trends in this industry (Groves, 2013). The vast amount of data generated and collected today by the pharmaceutical industry comes in many different forms, such as: R&D; clinical trials; insurance claims; physician notes within medical records; patient family history; images from patient scans; conversations about health in social media; and other monitoring devices (Ernst and Young, 2014). Insights from such vast amount of data have the potential to positively affect many aspects of the value chain of pharmaceutical innovation (drug innovation) (Sadat et al., 2014). Thus, an integration of Big Data initiatives in the pharmaceutical industry as in many other industry currently has been actively promoted and debated in the public and private sectors. For example, the National Institute of Health recently launched a Big Data to Knowledge Initiative (BD2K) to enable the biomedical research community to better access, manage, and utilise Big Data (Ernst and Young, 2014; Taylor, 2015). Some pioneering work is also being undertaken through large collaborations such as the National Patient-Centered Research Network (PCORnet), and Optum Labs, a research consortium that brings together academic institutions, health care systems, provider organisations, life sciences companies, and advocacy organisations (Feldman et al., 2012; Shah and Pathak, 2014).

While researchers and practitioners are still debating the definitions and boundaries of Big Data in the pharmaceutical sector, some academic studies (e.g. Srinivasan and Arunasalam, 2013; Li, et al., 2013; Lopez, et al., 2014) have demonstrated that Big Data applications can play a greater role in predicting the impact of disease. In particular, insights from analysis of large data sets have the power to help pharmaceutical companies personalise a medicine for each patient to ensure better and faster recovery (Feldman et al., 2012; Yaqoob et al., 2016). The main advantages of personalisation lie in greater customer satisfaction and higher profits (Arora et al., 2008). The aim of these analyses is to understand the outcomes of diseases and those risk factors that may affect patient care (Swan, 2013) and accelerate the individualisation of medical treatments (Deloitte, 2014). However, Arora et al. (2008) highlighted that even though personalisation relies on data, it drives pharmaceutical companies to stretch their data collection and management ability. Thus, personalisation is expensive in that it requires both data and costly software and hardware tools for implementation, such as computational infrastructure and the so-called “360-degree view” for example. The 360-degree patient view is the idea that pharmaceutical companies can get a complete view of patients by aggregating data from the various touch points that patients may use to contact a company to purchase products and to receive service and support (Feldman et al., 2012). Moreover, the effect of personalisation depends on the accuracy of the personalisation which in turn depends on transforming the data into insights and operationalising the results (e.g. to be able to offer the right product at the right time to the right patient).

Shah and Pathak (2014) found that in some cases Big Data may generate new patterns for increasing the efficiency of randomised clinical trials. Physicians have traditionally used their judgment when making treatment decisions, but in the last few years there has been a move toward evidence-based medicine, which involves systematically reviewing clinical data and making treatment decisions based on the best available information. Therefore, Big Data is becoming a valuable resource in advancing understanding of the complex biology that underlies personalised medicine. Moreover, a patient's response to therapy may also help pharmaceutical companies to improve drug development, reducing healthcare costs (Srinivasan and Arunasalam, 2013) and improving efficiency (Manogaran et al., 2017). Thus the main benefits of pharmaceutical companies applying Big Data include saving time and improving the overall quality of disease treatment and patient care, while at the same time reducing costs. For example, integrating population-scale clinical data sets with genomics data might help pharmaceutical companies move closer to getting more and better drugs approved in the first place, and more importantly, to getting the right drug to the right patient at the right time (Fledman et al., 2012).

However, challenges ahead include the need to bridge the current capabilities and technology gaps in the industry (Costa, 2014) such as, for example, computational infrastructure, new methods to interpret high volumes of generated data, and unique collaborative approaches between different functions (those capabilities that apply specifically to Big Data in the pharmaceutical industry will be discussed in detail later in this chapter). On the other hand, the nature of the pharmaceutical industry coupled with the fact that Big Pharma chiefly consists of MNCs, also creates challenges. Intra-organisational coordination of MNCs is becoming increasingly complex, demanding control of a multitude of factors at headquarters, subsidiary, franchise and managerial levels including: market and customer preferences, global and local competitors' strategies, host-country and home-country regulatory requirements, strategic alignments, managerial self-interest and the roles that individual managers play at both the headquarters and the franchises (Schotter and Beamish, 2011).

The pharmaceutical supply chain is a rich example of information that flows to many stakeholders. It presents structured and unstructured information, as well as both controlled and uncontrolled knowledge dissemination, and therefore it is important to map these information flows (Pedroso et al., 2008). Yet, because there are many players, there is no way to easily share data among different providers or facilities, partly because of a broad range of ethical, legal, and regulatory obstacles that increase the challenges to Big Data initiatives in Big Pharma. Thus, even within a single pharmaceutical company, important information can remain siloed within one group or department, mainly because of a lack of data integration and communication processes (Gover, 2013; Taylor, 2015)

While more flexible data collection, integration, and communication (along with new analytical methods) are crucial to the Big Data movement in the pharmaceutical sector, it has also been acknowledged that practical applications will be key to its success (Costa, 2014). For such success to be possible, all stakeholders must recognise the value of Big Data and be willing to act on its insights. This in turn will require many in the industry to undergo a fundamental shift in mind-set and culture, which is difficult to achieve (Kayyali et al., 2013). Therefore, these revolutionary changes in Big Data trends require new solutions, new tools and the development of capabilities to address such challenges. Thus, more empirical studies are needed to explore these processes, as there is currently a limited literature on this context, and as it has been highlighted earlier practical implications are key to understanding the process of the implementation of Big Data initiatives in the industry.

## 2.3 Big Data and Resource-Based View

### *2.3.1 Resource-Based View*

Due to the increased importance of dynamic market environments in the real world, many scholars (Barney, 1991; Teece et al., 1997; Grant, 2005; Teece, 2007) have focused on the Resource Based View (RBV). The RBV of a firm is central to strategic management research and is fundamental to understanding a company's success. The RBV shifts emphasis away from external factors, such as industry position and product development, towards internal company resources and capabilities to gain a competitive advantage (Penrose, 1959; Wernerfelt, 1984; Prahalad and Hamel, 1990; Amit and Schoemaker, 1993; Grant, 2005).

The idea of looking at firms as a broader set of resources goes back to the work of Penrose: The Theory of the Growth of the Firm (1959) in which Penrose argues that there is a strong relation between a firm's range of resources and the development of ideas, experience, and knowledge of its managers. Penrose (1959) suggests that resources consist of a bundle of potential services. Analogously, Wernerfelt (1984) argues that viewing firms in terms of their resources leads to different immediate insights than the traditional product perspective. Wernerfelt (1984) proposes that instead of seeing resources as anything that could be associated with a firm's strengths and weaknesses, resources should be considered from a different viewpoint. For example, firms can identify types of resources that can lead to high profits or develop new resources to capitalise on better performance. Although Wernerfelt was not writing about a particular set of resources, such as IT resources or Big Data, it can be argued that companies can capitalise on increasing data volumes to potentially improve their performance.

The debate on the potential benefit of capitalising on resources is taken further by Barney (1991) who argues that firms can generate a sustainable Competitive Advantage (CA) from their resources. CA refers to a firm's position when they have implemented a value-creating strategy that is not simultaneously implemented by their competitors (Barney, 1991). It has been widely accepted that elements for competitive advantage and value-creating strategies lie in a firm's heterogeneous resources (Wernefelt, 1984; Barney, 1991; Peteraf, 1993; Teece et al., 1997). However, it should be acknowledged that not all resources have the same potential to generate a sustainable competitive advantage. In order to create a competitive advantage, managers have to develop and obtain valuable, rare, inimitable, and non-substitutable resources (VRIN) within the firm (Barney 1991). The VRIN framework introduced by Barney, which was revised later by Barney and Hesterly (2012, p. 94) as a VRIO where O stands for Organisation, has been acknowledged as a tool that can be used to determine a firm's resource competitive potential, although its applicability and practicality has been challenged (Priem and Butler, 2001; Kozlenkova et al., 2013), mainly due to a lack of empirical support. For example, Armstrong and Shimizu (2007) found that it is difficult to objectively observe dimensions such as value and inimitability of resources, and so it is hard to measure them. Furthermore, authors such as (Wade and Nevo, 2010; Ambrosini and Bowman, 2009; Barreto, 2010) highlighted that while a single resource can be viewed as valuable, it is only collaborative combination with other resources and capabilities that can result in actual competitive advantage.

Building on the views above, it must be argued that Big Data as a new resource can only be leveraged if carefully combined with other existing or new resources and capabilities of the firms involved.

### *2.3.2 Resource and Capabilities in RBV*

Building upon earlier works, recent literature on the resource and capabilities of RBV can be roughly divided into two groups. The first group categorises resources rather broadly, and includes all assets, capabilities, organisational processes, firm attributes, information, and knowledge (Barney, 1991, p.101). The second group clearly distinguishes the resources and capabilities of a firm (Amit and Schoemaker, 1993; Grant, 2005; Helfat et al., 2007) by arguing that resources are '*the productive tangible (a land, a plant or equipment) and intangible (customer relationship, know-how, or brand name) assets that can be traded by the firm*' (Grant, 2005, p. 138). As represented in figure 2.2 Grant (2008, p. 131) offers a classification of resources as follows.

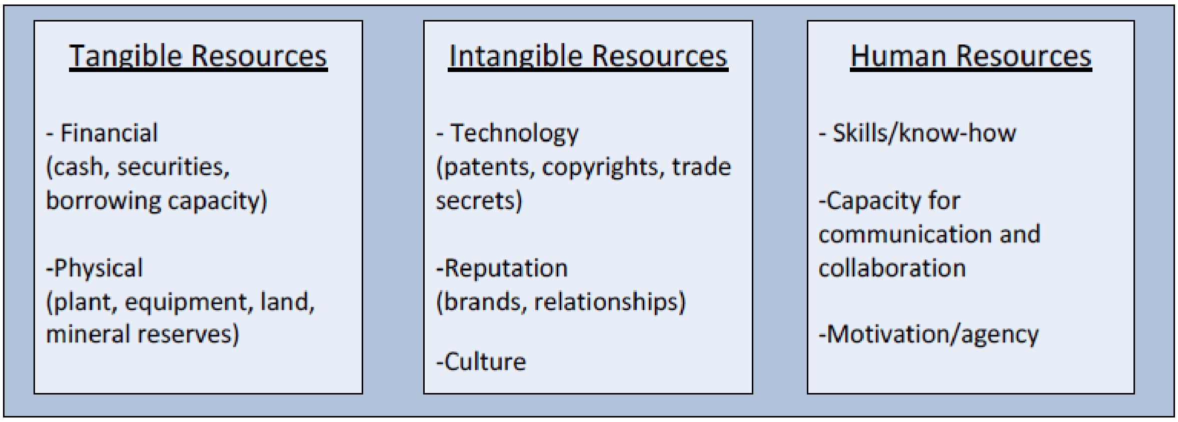



*Figure 2.3: Resource Typology (adapted from Grant, 2008, p. 131)*

Capabilities refer to '*a firm's capacity to deploy resources for a desired outcome*' (Grant, 2005, p.138). While resources or factor inputs are available to all firms, the '*capability*' to deploy them productively is not uniformly distributed (Ethiraj et al., 2005). Furthermore, in contrast to resources, it has been argued that capabilities have to be built within the company and not brought in (Amit and Schoemaker, 1993; Makadok, 2001). This study adopts the latter conceptualisation of resource and capabilities in order to understand how organisations develop capabilities to effectively use Big Data as a resource.

### *2.3.3 Capabilities, Routines, and Competencies*

*- Capabilities*

The diverse nature of capabilities, along with the rapid growth of academic literature in this area, has led to a complex body of research around the topic. However, Ethiraj et al. (2005)

argue that there is still a limited understanding in academic literature about the origins of capabilities or how capabilities are developed, maintained, and leveraged. Esterby-Smith et al. (2009, p. 4.) argue that the problem of studying organisations' capabilities is associated with its nature, '*Tacit and / or intangible organisational elements*,' such as routines, processes, managerial cognition, and knowledge. However, due to the complexity of organisational and managerial capabilities, and their importance for both strategic management research and practice, there is an opportunity to advance research on capabilities in many areas (Esterby-Smith et al., 2009).

According to Winter (2003, p. 991) an organisational capability is '*a high level routine (or collection of routines)' that, together with its implementing input flows, confers upon an organisation's management a set of decision options for producing significant outputs of a particular type*'. Following this definition, capabilities have been recognised as a key explanatory variable for differences in organisational behaviour and the consequent outcomes (Dosi et al., 2000; Eisenhardt and Martin, 2000; Zollo and Winter, 2002). Furthermore, resources and experience are seen as inputs to capabilities (Felin et al., 2012). In this study the definition of capability follows these ideas. The importance of a firm's capability is further argued in a study conducted by Grant (2010) that demonstrated that capabilities emerge from the cooperation and coordination of a set of resources within a firm and hence a capability is a firm's capacity to deploy resources for a desired outcome (Grant, 2015). Understanding of capabilities in relation to the resources and their capitalisation therefore becomes fundamental to this study.

- *Routines*

At this point, it is important to bring in scholarly opinions on routines, which have been defined as a *'repository of organisational capabilities'* (Winter, 2003, p. 991). Winter (2003) argues that organisational routines are the basis of capabilities and are thus important factors to be considered when building capabilities. Moreover, some scholars argue that routines are microfoundations of capabilities and are important because they form '*the building blocks of capabilities'* (Nelson and Winter, 1982; Teece et al., 1997; Winter, 2000; Dosi et al., 2001, p. 4). Routines has been described as an organisational behaviour: actions that are to be regularly carried out (Nelson and Winter, 1982). Consequently, routines can be defined as repetitive, recognisable patterns of interdependent actions, carried out by multiple actors or as repeated patterns of response (Feldman and Pentland, 2003). Capabilities, on the other hand, can be described as the ability of an organisation to take/perform an action. It has been argued that routines accumulate past knowledge regarding organisational successes and failures, while being embedded in a particular structure, such as a physical space (Nelson and Winter, 1982; Winter, 2003). This means that knowledge regarding routines is key to a correct understanding of capabilities, and vice versa (Salvato and Rerup, 2011).

- *Competencies*

Other relevant literature relating to resources and capabilities relate to an organisation's competencies. It should be acknowledged that in some cases the terms capabilities, competencies, and routines, are defined similarly. Additionally, in some cases the literature uses the term *capabilities* and *competencies* interchangeably (Grant, 2005. p. 144). However, although each of them incorporates a combination of knowledge, skills, abilities, and actions, they are not same (Prahalad and Hamel, 1990; Collis and Montgomery, 1997; Dosi, 2003; Grant, 2005). For example, Stalk et al. (1992. p. 63) explain that *capabilities* are applicable to the whole value chain, while *competencies* are limited to functional areas within the organisation. Organisation can have an excellent competencies in a narrow area of expertise but lack the capability to apply them effectively for example through ineffective marketing, distribution, customer service, or information processing (Smith, 2008). However, Prahalad and Hamel (1990) suggest that organisations need to understand their core competencies in order to successfully deploy their resources. Core competencies are skills and organisational knowledge that are shared across different business units of an organisation. Furthermore, competencies are a source of differentiation for the organisation that allow it to create and offer unique products and services to customers (Smith, 2008). Lado and Wilson (1994, p. 702) state that competencies '*include all firm specific assets, knowledge, skills and capabilities embedded in the organisations' structure, technology, and processes.'* McGrath et al (1995, p. 254) consider competencies as '*a purposive combination of firm-specific assets (or resources) which enable it to accomplish a given task'*. Based on these definitions competencies can be conceptualised as representative of organisational routines and processes which are enabled when firm-specific assets are assembled in integrated clusters across individuals and groups (Teece et al., 1997) as the collective learning in an organisation, especially how to coordinate diverse production skills (Prahalad and Hamel, 1990), and as integrated multiple streams of technologies and organisational knowledge that are shared across different business units of an organisation (McGrath et al., 1995, p. 254). Thus, *competencies* in this research are understood as being more than what an organisation does on a daily basis, they are also what the organisation is doing particularly well relative to its competitors (Selznick, 1957) in terms of continuously improving its performance. In contrast, the term *capabilities* in this research refers to a broad set of abilities in which a company has capacities that are rooted in daily operations related to different functions/operations.

### *2.3.4 Big Data in RBV*

As seen through the lens of the theoretical perspective laid out in the previous sections, Big Data as an intangible resource can be considered as potentially strategic.

Strategic resources are those that allow you to achieve strategic goals and therefore generate sustainable competitive advantage (Barney, 1986). Whether leading to better performance or generating sustainability, Competitive Advantage (CA), Wernerfelt and Barney's work provides a solid foundation for the argument that Big Data, when fully utilised and capitalised, can be a strategic resource that can greatly benefit companies. Barney (1986, p. 658) states that '*strategic and valuable resource must enable a firm to do things and behave in ways that led to high sales, low costs, high margins or in other ways to add financial value to the firm'*. As an example, today's biggest companies (Apple, Amazon, Microsoft, Facebook) by market capital valuation are data technology businesses. These disruptive innovators use Big Data solutions as competitive advantages to reduce operational costs, increase revenue, predict behaviour, improve cash flows (Davenport, 2013; Sun et al., 2016). They link Big Data into every function of the organisation. However, as previously mentioned, the value of Big Data does not come about through its ownership – rather, it only has economic value if it is implemented effectively. Moreover, some authors (Bharadwaj et al., 2013; Erevelles et al., 2015) argue that a digital business environment brings additional dimensions that alter the nature of creation, capture, and distribution of business value among competitors. Therefore, a more refined and detailed understanding of Big Data as a new strategic resource is critical to this study.

The reason this research refers to Big Data as intangible rather than tangible is that under current accounting rules, generally, only items of tangible value purchased by a company are listed as an asset (FSAB, 2019). Intangible resources are, unlike tangible resources, not documented on an organisation's financial statements (Grant, 2016, p. 128). While some tangible resources such as (stocks, real estate holdings, land, etc) are easy to measure and show on a balance sheet, intangible resources (including patents, copyrights, trademarks, and brand names) are notoriously hard to objectively value as their value ultimately depends on a business' capacity to use them. Therefore, they are not to be placed on the balance sheet. Exceptions arise in relation to goodwill (The value of a company's brand name, solid customer base, good customer relations and good employee relations). Goodwill is an intangible asset associated with the purchase of one company by another. Specifically, goodwill is recorded in a situation in which the purchase price is higher than the sum of the fair value of all identifiable tangible and intangible assets purchased in the acquisition and the liabilities assumed in the process. Goodwill is recorded on the balance sheet as a noncurrent asset meaning it is a long-term asset similar to fixed assets like property, plant, and equipment. However, the Financial Accounting Standards Board (FASB) is guiding how to determine the value of goodwill for a company (Wasserman, 2018).

Although it is common for businesses to refer to data as an asset, since Big Data is routinely produced by a business and often is not purchased, it typically is not recorded on the balance sheet. Yet, this undeniably valuable resource is currently not established enough to be used to its full potential to the same extent as its physical assets counter-parts (Gartner, 2018). This lack of maturity means that, currently, data and information are unable to be recognised on financial statements and are difficult or impossible to officially value. Thus, in 2016 the Financial Accounting Standards Board (FASB) assembled a group of researchers to study the possibility of updating its accounting rules to potentially record data as an asset. Gartner (2018) states that although Big Data arguably meets the formal criteria of a business asset, present-day accounting practices prevent it from being counted as a tangible asset, therefore before the FASB can decide how to best estimate data value and encourage the viewing of data as an asset, the accounting rules currently in place will need to be applied. Short (2018) states that issues preventing understanding of how organisations can value its Big Data initiatives can potentially be solved using insights from empirical research. By being able to reliably determine the value of Big Data resource, organisations will be closer to being able to account for them in their balance sheets and other financial statements. Furthermore, if an organisation can value its data it is then able to make more effective strategic decisions, especially when those decisions relate to their data and information systems (Wamba, 2015). Thus, regardless of whether Big Data is currently included on balance sheets, learning to manage, deploy, value, and treat data as an tangible asset can help with understanding the ROI of both Big Data Management and Big Data investments.

### *2.3.5 RBV Applications and Limitations*

While the RBV as a theoretical framework has been acknowledged to help the study of organisational resources and capabilities, its practicality and empirical perspective have been challenged (Priem and Butler, 2001; Newbert, 2007; Armstrong and Shimizu, 2007). A study conducted by Armstrong and Shimizu (2007, p. 975) found that a major challenge for researchers in empirically testing the RBV is that of isolation and operationalisation of resources. However, while resources are necessary to deliver capability, it has been argued (Armstrong and Shimizu, 2007; Nevo and Wade, 2010; Arend and Levesque, 2010) that the resource-based view of competitive advantage is too static to explain how firms create new capabilities to leverage opportunities within dynamic markets. With fast-changing markets or evolving technologies, organisations must develop new capabilities that permit them to out-perform their competitors. However, routines, competencies, and capabilities are often discussed without full consideration being given to such rapidly changing environments. Some scholars (Agarwal and Dhar, 2014; Braganza et al., 2017) have questioned the applicability of the RBV for Big Data initiatives - in particular, the known limitations of RBV when applying Big Data initiatives implementation. Braganza et al. (2017) also suggest that even though RBV provides VRIN framework to consider Big Data as a strategic resource and, even more importantly, enables discussion of Big Data’s contribution to competitive advantage, RBV may not be able to explain management of resources in Big Data initiatives. In Big Data initiatives the core resource, data, is not rare. RBV suggests that where organizations have access to scarce resources, they use these rare resources to achieve competitive advantage. Consequently it may be difficult to explain the capabilities development process for such initiatives.

In response to enquiries into how and why certain firms have competitive advantage in situations of rapid and unpredictable change, the RBV has been extended to dynamic markets by introducing the Dynamic Capability (DC) perspective. Teece et al. (1997) shift the focus from the firm's resource configuration to organisational capabilities that define these resource configurations according to the environmental conditions and proposed DC theory. This approach extends the resource-based view argument by addressing how Valuable, Rare, difficult to Imitate and Non substitutable resources (VRIN) can be created and how a firm's current valuable resources can be leveraged, renewed, and reconfigured in changing environments (Teece et al., 1997).

In brief, the DC theory shares much common ground with the RBV in terms of having an internal focus on the purposeful use of resources. However, the mechanism, logic, and perspective of the two approaches have pre-eminent differences (Lopez, 2005). Therefore, it may make Dynamic Capability more appropriate as a theoretical perspective for making sense of organisation's Big Data initiatives in the turbulent 21st century's digital business environment. Thus, selecting a DC as a main theoretical lens is believed to be the most appropriate choice for this research (as will be seen, the next section talks more about the justification behind taking a DC perspective).

## 2.4 Dynamic Capabilities (DC) Theory

### *2.4.1 Different Definitions of the DC*

Research that has been conducted since the introduction of the Dynamic capability theory by Teece et al. (1997) has yielded a large array of explanations and definitions of dynamic capabilities (Grant, 1991; Teece et al., 1997; Eisenhardt and Martin, 2000; Zollo and Winter, 2002; Helfat et al., 2007; Ambrosini and Bowman, 2009). However, it must be acknowledged that while there are several alternative definitions of dynamic capabilities, its conceptualisation has been heavily influenced by two academic papers Teece, Pisano, and Shuen (TPS) 1997 and Eisenhardt and Martin (EM) (2000) (Di Stefano and Verona, 2013; Peteraf et al., 2013). Table 2.3 at the end of this section summarises alternative definitions, and also those organisational and managerial abilities and processes referred to as DC that have been identified in the literature. To visualise which definition and approach has been influenced by a particular author there are two colours in the table 2.3. Light blue represents definitions and authors that have been influenced by TPS, while dark blue colour illustrates EM's approach.

In general, DC theory focuses on the organisational perspective, explaining the need for an organisation to address the rapidly-changing business environment by developing dynamic capabilities. It views the business environment as an overall framework within which the organisation operates. The Dynamic capability theory looks at the ways that resources can be better utilised to address the changing needs and requirements of a business. It also examines the possibility of an organisation to *(how an organisation can/might be able to)* shape its environment to ensure competitive advantage.

Therefore, both TPS and EM works are complementary in many respects in that they both consider managerial and organisational processes, and identify the importance of routines and recommend DC as an extension to the resource-based view. However, Peteraf et al. (2013) argue that the two approaches have different theoretical underpinnings, and represent different approaches for conceptualising dynamic capabilities. Peteraf et al. (2013) also argue that each approach employs different types of reasoning, and reach different conclusions. Table 2.2 below highlights the main differences between the two approaches.

| Differences | Teece, Pisano, and Shuen (TPS) | Eisenhardt and Martin (EM) |
|---|---|---|
| **Differences in Definition** | Define dynamic capabilities as a **firm's ability** | Define as specific and identifiable **processes embedded in firms** |
| **Differences in importance of DC** | Acknowledge the importance of DC to **address rapidly changing environments** | Acknowledge the importance of dynamic capabilities **also in moderate environments** |
| **Differences in outcome of DC** | Ability to achieve **new and innovative forms of competitive advantage** | Dynamic capabilities do not always lead to advanced performance or competitive advantage. **They can be a source of only limited competitive advantage** |
| **Differences in object of action of DC** | Acknowledge DC as a complex routines that are more **concerned with changing existing resources and capabilities** | Acknowledge DC as a best practice or simple rules that are more likely to be involved in **developing something new in response to new opportunities** |
| **Differences in how to study the DC** | Study technological and environmental changes, firm's performance, and strategy | Study internal organisational issues, practice, processes and information system |

*Table 2.2: Main differences between TPS and EM approaches (Author's own)*

Teece et al. (1997) define dynamic capabilities as a firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments. In contrast, Eisenhardt and Martin (2000. p.1106) present dynamic capabilities as specific and identifiable *processes embedded in firms*. Eisenhardt and Martin (2000. P. 1107) state that '*dynamic capabilities are integrated processes, and that they consist of identifiable and specific strategic routines by which firms achieve new resource configurations as markets emerge, collide, split, evolve, and die'*. Furthermore, Eisenhardt and Martin (2000) also acknowledge the importance of dynamic capabilities in moderate environments, where change occurs frequently but along predictable paths. For example, the authors explain a firm's strategic decision-making as a dynamic capability in which managers pool their various business, functional, and personal expertise to make choices that shape the major strategic moves of the firm (even in a moderate environment). Moreover, by characterising DC as a *'best practice'* or *'simple rules'* and *'experiential processes'* EM implies that DC can be a source of only limited competitive advantage, while TPS states that dynamic capabilities reflect an organisation's ability to achieve new and innovative forms of competitive advantage when operating in an environment of rapid technological change (Tecce et al., 1997, pg. 516).

Beyond differences between the two approaches highlighted above, the relationship between DC and an organisation's performance has been most debated among strategic management scholars. While some authors (Tecce et al., 1997; Makadok, 2001; Ambrosini and Bowman, 2009) believe there is a direct relationship between an organisation's dynamic capabilities and its performance, Eisenhardt and Martin (2000) and Helfat et al. (2007) suggest that dynamic capabilities do not always lead to improved performance. Among these views, Zott (2003), Protogerou et al. (2011) and Pavlou and El Saway (2011) propose that there is an indirect link between dynamic capabilities and performance. For example, Protogerou et al. (2010) found that dynamic capabilities have a positive impact on operational capabilities (marketing and IT) and an organisation's performance. The authors argue that the transformation and reconfiguration of operational capabilities (which are a firms' basic functional activities) has an indirect impact on a firm's performance. DC can be seen as higher-order strategic processes that integrate, recombine, and generate new technological and marketing capabilities, which in turn impact a firm's performance. This finding was supported by Pavlou and El Saway (2011), who also found that DC have an indirect positive effect on performance by reconfiguring operational capabilities into new ones that better fit the environment.

The diverse nature of the capabilities, along with the rapid growth of academic literature in this area, has led to a complex body of research around the topic. Understanding how capabilities are developed, maintained, extended, leveraged, and adapted has been debated and investigated from the micro and macro perspectives of companies (Teece, 2007; Ambrosini and Bowman, 2009; Felin et al., 2012). The benefits from the micro-foundation approach lie in a consideration of lower-level entities, such as individuals or processes in an organisation and their interactions. A micro-foundational approach, however, does not exclude the idea that collective-level constructs can offer suitable explanations for understanding routines and capabilities (Felin et al., 2012). Some authors (Teece, 2007; Ambrosini and Bowman, 2009; Protogerou et al., 2011) suggest that in order to understand dynamic capabilities it is important to focus on the processes that underpin them. However, there are many processes that operate within an organisation, and it is hard to distinguish which of them has a direct link to dynamic capabilities (Protogerou et al., 2011). For example, Zollo and Winter (2002) identify the importance of organisational routines of learning mechanisms as an important process for the development of dynamic capabilities, such as experience accumulation, knowledge articulation, and knowledge codification. Organisational learning is defined as '*the capacity or process within an organisation to improve or maintain performance based on experience'* (Nevis et al., 1995, p 73). However, Swift and Hwang (2008) found that the development and codification of routines in organisational learning processes critically depend on various social and managerial processes, such as supportive leadership, teamwork, and the free flow of information across all areas of the organisation.

Teece et al. (1997) propose a combination of three organisational and managerial processes as core elements of dynamic capabilities: 1) coordination/integrating, 2) learning, and 3) reconfiguring. These processes support sensing, seizing opportunities, and managing threats, and together are thought of as asset "*orchestration*" processes (Teece, 2007, p. 1341). Ambrosini and Bowman (2009) also acknowledge that dynamic capabilities do not appear as a fully formed capability. The authors argue that they are an outcome of learning and experience within an organisation; however, management cognition also plays a critical role in building, integrating, and reconfiguring the capability base of an organisation. These authors believe that dynamic capabilities should have four main processes: reconfiguration, leveraging, learning, and creative integration (Ambrosini and Bowman, 2009).

Table 2.3 below summarises alternative definitions and organisational and managerial processes (the way things are done in the firm, or what might be referred to as its routines, or patterns of current practice (Teece et al., 1997) of the dynamic capabilities discussed above and identified in the literature.

| **Authors, date** | **Definition** | **DC / managerial and organizational processes that underpin DC (the way things are done in the firm, or what might be referred to as its routines, or patterns of current practice (Teece et al., 1997)** | **Function, Aim, Goal** |
|---|---|---|---|
| Grant, 1991 | Dynamic capabilities respond to changing environments that offer a sustained competitive advantage | | Develop a sustained competitive advantage |
| Leonard-Barton, 1992 | Dynamic capabilities reflect an organization's ability to achieve new and innovative forms of competitive advantage given path dependencies and market positions | | Exploration of new opportunities |
| Teece, Pisano and Shuen,1997 | The firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly-changing environments | Reconfiguring, learning, integrating, and coordinating | Develop sustainable competitive advantage<br>Enable firms adapt internal and external change |
| Eisenhardt and Martin, 2000 | Dynamic capabilities are the organisational and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split, and evolve | The firm’s processes that use resources – specifically the processes to integrate, reconfigure, gain and release resources – to match and even create market change<br>Repeated practice and consequent experience, past mistakes, and new experiences | Tools that enable the reconfiguration of existing operational capabilities to match and create market change |

| | | | |
|---|---|---|---|
| Zahra and George, 2002 | Dynamic capabilities are essentially change-oriented capabilities that help firms redeploy and reconfigure their resource base to meet evolving customer demands and competitor strategies | Integration and reconfiguration | Integrating fundamental variations through reconfigurations |
| Zollo and Winter, 2002 | Dynamic capabilities are learned and stable patterns of collective activity, through which the organisation generates and modifies operational routines | Dynamic capability is the function of three generic learning processes: experience accumulation, knowledge articulation, and knowledge utilization | Systematic and persistent modification of routines |
| Winter, 2003 | Dynamic capabilities govern the rate of change of resources and ordinary capabilities | Process of changing ordinary capabilities | *Ad hoc* problem solving |
| Helfat et al., 2007 | Dynamic capabilities have the capacity for an organisation to purposefully create, extend, or modify its resource base | Purposefully change resource base. | Identifying needs or opportunities for change, and accomplishing that change |
| Teece, 2007 | Dynamic capabilities can be disaggregated into three capacities: (1) to sense and shape opportunities and threats, (2) to seize opportunities, and (3) to maintain competitiveness through enhancing, combining, protecting and, when necessary, reconfiguring the business enterprise's intangible and tangible assets | Process of sensing the environment to seize opportunities and reconfigure assets | "Orchestration" of a firm's resources and ordinary capabilities that allow it to adapt and evolve |
| Wand and Ahmed, 2007 | Dynamic capabilities as a firm's behavioural orientation constantly to integrate, reconfigure, renew, and recreate its resources and capabilities and, most importantly, upgrade and reconstruct its core capabilities in response to a changing environment to attain and sustain competitive advantage | Dynamic capabilities underline the processes of transforming firm resources and capabilities into outputs in such forms as products or services that deliver superior value to customers; such transformation is embarked on in a swift, precise, and creative manner in line with the industry's changes<br>Adaptive capability, absorptive capability, and innovative capability. | Source of sustained competitive advantage |
| Cepeda and Vera, 2007 | Dynamic capabilities are about how firms develop new skills and routines that allow them to complete. | Knowledge management process and configuration of knowledge, configuration of resources and operational routines | Configuration of functional competence to better match the changing environment |

| | | | |
|---|---|---|---|
| Ambrosini and Bowman, 2009 | Dynamic capabilities are compromised of four main processes: reconfiguration, leveraging, learning and integration. DC is a process that impacts upon resources. They are future-oriented | Reconfiguration, leveraging, learning, and creative integration | Continuous improvement for incrementally adjust and adapt change (incremental change).<br><br>Renew or refresh the resource stock to avoid core regicides.<br><br>Move away form previous change practices towards new one(Regenerate existing capabilities ) |
| Protogerou et al., 2011 | Dynamic capabilities can be seen as the capacity of an organisation to purposefully and systematically create, extend, or modify its operational capabilities | Coordinating/integrating, learning, and strategic competitive response | Sense and strategically respond to environmental challenges<br><br>Facilitate change within an organisation |
| Barreto, 2010 | A dynamic capability is the firm's potential to systematically solve problems, formed by its propensity to sense opportunities and treats, to make timely and market-oriented | Sense the opportunities and treats, make timely decisions, make market oriented decisions, and change the resource base | Monitor the external environment in order to spot and address opportunities and threats |
| | | | |

*Table 2.3: Dynamic Capabilities (DC) Theory, Definitions, Processes, Aim, and Function*
(Author's own)

This research adopts the definition of DC introduced by Teece (2007), who describes dynamic capabilities as a firm's ability to '*orchestrate*' its resources and ordinary capabilities in order to adapt and evolve to rapidly-changing environments (Teece, 2007, p.1344). What distinguishes this definition from others, particularly from the EM's approach, is that this definition identifies DC as relevant to addressing rapidly-changing environments and emphasise the firm's ability to identify and exploit opportunities. This is particularly important for this research to reflect the dynamism of the digital environment and conceptualise the capabilities development process for Big Data initiatives.

Within this definition, Big Data can be viewed as a new resource for modern companies to be combined with ordinary capabilities in order to successfully operate in a rapidly-changing environment. Furthermore, Teece et al. (1997) explain that a capability has a key function in strategic management in appropriately adopting, integrating, and reconfiguring internal and external organisational skills, resources, and functional competencies to the requirements of a changing environment. This view goes beyond the RBV scholarship, integrating changes such as dynamic environments with constantly changing IT resources.

Another argument about generating value from new resources has been put forward by Penrose (1959), who presents a view that the value from a new resource does not only come from owning the resource, but how it is deployed and combined with existing resources and capabilities. These two separate but related views (Teece et al. and Penrose) justify the necessity of integrating, building, and reconfiguring internal and external resources and capabilities in the case of implementing Big Data initiatives.

### *2.4.2 Hierarchy of Capabilities Operational and Dynamic Capabilities*

Usually, capabilities are categorises by their type and importance, and how they are seen in a firm's value-creating processes (Grant, 2005). Broadly defined, *capabilities are formed by integrating more specialised capabilities* (Grant, 2005). For example, functional capabilities such marketing, IT, and management capabilities are the combination of more specialised capabilities related to a particular task. These types of capabilities reflect a firm's ability to perform basic functional activities (Helfat and Peteraf, 2009; Winter, 2000). Capabilities that are generated to directly support the operational function of the firm are defined as operational or ordinary capabilities (Collis, 1994; Cepeda and Vera, 2007; Helfat and Winter, 2011).

It must be acknowledged that the terms *ordinary* and *operational* have been used interchangeably in the literature. However, both serve the same meaning. In the interest of consistency, this research adopts the term operational as it aims to look at firms two main operational marketing and IT capabilities in relation to Big Data. Furthermore, the definitions and explanations that this research adopts and follows mainly use the term *operational* rather than *ordinary* (Teece et al., 1997; Teece et al., 2007; Ambrosini and Bowman, 2009; Protogerou et al., 2011).

Operational capabilities enable an organisation to perform an activity on an on-going basis. Typical operational capabilities serve the firm's current means of generating revenue and profit. These types of capabilities, however, are not responsible for sensing/ the detection of new business opportunities. They shape organisations current day to day activities (Teece, 2007). In contrast, higher-level capabilities such as dynamic capabilities (strategic decision making, resource allocation, alliance, and acquisition) require integration and coordination of lower-level capabilities. Dynamic capabilities reconfigure operational capabilities in order to achieve flexibility (Helfat et al., 2007, p. 7; Newey and Zahra, 2009, p. 82; Teece et al., 1997; Protoderou et al., 2011). To understand the differences between different types of capabilities some authors such as (Collis, 1994; Winter, 2003) proposed a hierarchy of capabilities. Three levels of capabilities have been identified in the literature: first-order, second-order, and higher level or 'm*eta-capabilities*' (Collis, 1994; Winter, 2003). Collis (1994) names resources themselves as a first-order capability, while Winter (2003) referred to them as 'zero level'. Winter (2003) explains that ordinary capabilities are zero-level capabilities without which the firm cannot exist – thus making an argument that every existing company can be said to have at least some *ordinary* capabilities. Those capabilities that would change the firm's processes, customer relationships, or scale have been described as second-level capabilities (Collis, 1994) or as dynamic capabilities according to Winter (2003). Dynamic capabilities govern the rate of change of operational capabilities and therefore can be understood as a higher-order constructs, that link to an organisation's ability to sense and then seize new opportunities in a changing environment (Collis, 1994; Winter, 2003; Teece, 2007). However, the ability of being able to identify opportunities depends on the organisation's learning capacities. A good example would be an ability to learn about a new environment or technological changes (Teece, 2007). Collis (1994) believes that capabilities can be renewed endlessly, and that third-order or "Meta capabilities" (Collis, 1994) are the result of renewed processes. These are capabilities that allow the firm to outperform its competitors.

Based on the discussion above we can conclude that dynamic capabilities are not capabilities in same sense as capabilities in RBV. Rather, they are organisational and managerial abilities (the way things are done in the firm, or what might be referred to as its routines, or patterns of current practice) (Teece et al., 1997) that impact upon existing resources. Dynamic capabilities help firms to extend, modify, and reconfigure their existing operational capabilities into new ones that better match the changing environment (Ambrosini and Bowman, 2009; Pavlou and El Sawy, 2011). Developing and moderating operational and dynamic capabilities have become key facilitators for companies in an emerging changing environment. In particular, the relationship between Big Data and dynamic capabilities is important, as Big Data initiatives need to be altered over time, as an organisation will need to reconfigure or develop new capabilities to achieve the promised results from Big Data initiatives (Braganza et al., 2017). However, in order to better understand dynamic capabilities, Pavlou and El Sawy (2011) suggested that it is important to recognise their distinction from operational capabilities, as dynamic capabilities aim to moderate operational capabilities in order to leverage competitive advantage from a new resource. Nonetheless, Zhou and Li (2010) made an important point by arguing that the existing literature does not touch on the practical issues that companies face in developing their operational and dynamic capability, which represents a significant research gap, particularly in the Big Data era.

## 2.5 Big Data Related Challenges and Required Capabilities

### *2.5.1 IT capabilities*

Although advantage can be derived from the analysis of Big Data (see Section 2.2), there also exist some barriers to its effective use (LaValle, 2009). New types of data, such as geospatial data, social media, voice, video, and other unstructured data all have a part to play in understanding customers and anticipating their future behaviours. However, the data available from these sources are often unstructured. A brief explanation of the difference between structured and unstructured data will demonstrate the significance of this problem.

Structured data are organised in an assigned format that can be managed and used by database management systems, such as Microsoft Oracle, and SQL. Such data are a key resource for decision-making in many organisations. In turn, unstructured data are unformatted and have no predefined standard. It has thus been argued (Setia et al., 2013; George et al., 2014) that extracting valuable knowledge from Big Data is more challenging than analysing tasks in traditional data warehouses.

The emergence of new data management technologies and capabilities which enable organisations to leverage Big Data in their business processes has become a critical challenge for many companies seeking to implement Big Data into their operations (Gandomi, et al., 2014). It has been suggested (Danneels, 2010, Chen et al., 2012) that to put Big Data into action and into specifically-directed initiatives, a firm must have the information technology (IT) capabilities. The IT capability reflects an organisation's capacity to employ technologies to convert input to output (Wilden and Gudergan, 2014). Furthermore, the notion of IT capability emphasises the ability of a firm to organise and deploy IT based resources in combination with other organisational resources and capabilities in support of business strategies and organisational processes (Bharadwaj, 2000). The importance of IT capabilities in the case of the Big Data initiatives has been acknowledged as being particularly acute in their relevance to the process of transforming Big Data resources into potentially competitive assets (Chen et al., 2012; Erevelles et al., 2015). Some authors (Grover, 2008; Mikalef and Pateli, 2017) suggest that IT capabilities should be measured and examined in terms of the organisational processes they enable. In this respect, IT serves as a means through which new organisational capabilities can be created or existing ones improved. In fact, Mikalef and Krogstie (2018) suggest that fundamental business transformations are often a result of integrating IT into business processes. Even though it has been acknowledged (Bhatt and Grover, 2005) that IT capability might not be a source of competitive advantage *per se*, it can provide value in terms of efficient output - thus their absence might create a competitive disadvantage to companies. However, it has also been acknowledged that even beneficial IT capabilities might not remain valuable in the event of an environmental change (Leonard-Barton, 1992). Chen et al. (2012) mention the rise of semi-structured and unstructured data that calls for *ad hoc* and real-time extraction, processing, and analytics in a new technological environment resulting in increased demand for advanced IT capabilities.

### *2.5.2 Big Data Analytics*

Developing Big Data technology is often mentioned as one of the main areas to solve the Big Data challenges (Chen et al., 2012; Wamba, 2017). Such technology is associated with Big Data Analytics (BDA) in the literature (Gupta and George, 2016; Garmaki et al., 2016; Wamba, 2017; Mikalef and Krogstie, 2018), which is on the other hand considered as an advanced IT in Big Data environment (although Big Data technology may more correctly be considered as advanced IT infrastructure). More properly, BDA are less about hardware and more about technologies (e.g. database and data-mining tools) and techniques (e.g. analytical methods) that a company can employ to analyse large scale, complex data (Chen et al., 2012; Kwon et al., 2014) and leverage insights that were not achievable with past technology (Garmaki et al., 2016). Such technologies can include data management, open-source programming (e.g.

Hadoop, MapReduce), statistical analysis (e.g. sentiment analysis), and advanced visualisation tools that help structure and connect data to uncover hidden patterns, unknown correlations, and other actionable insights (Wamba, 2017). To obtain business value from BDA it has been argued that there is a need for investments into Big Data Analytics Capabilities, or BDAC (Gupta and George, 2016). Cosic et al. (2012, p. 4) define BDAC as '*the ability to utilize resources to perform a business analytics task, based on the interaction between IT assets and other firm resources'*. Garmaki et al. (2016) highlight the combination of data and IT assets and define BDAC as an organisation's ability to exploit the combination of data and IT components with the intention of achieving competitiveness. In recent years, several researchers (Gupta and George, 2016; Wamba et al., 2017; Wang et al., 2018; Mikalef and Krogstie, 2018) have focused their attention on understanding these capabilities. For example Wamba et al. (2017) suggested a model of Big Data analytics capabilities that includes three principal factors: expertise capabilities, management capabilities, and technology skills. However there are additional capabilities that have been identified in the reviewed literature, including a data-driven culture or organisational agility (LaValle, 2009); top management support and organisational capabilities (Erevelles et al., 2015; Gupta and George, 2016) that are missing from the Wamba's framework. In the case of Big Data case, for example, Erevelles et al. (2015) note that organisations need to establish physical capital resources – a platform, software and hardware – that are capable of storing and analysing large amounts (*volume*) of data in real time (*velocity*) from many different sources (*variety*). Human capital resources are also needed – skilled workers, including data scientists and IT people – who know how to extract information from consumer activities, as well as to manage and extract insights from Big Data. In addition, authors are highlighting the importance of organisational capital resources - including an organisational structure that allow insights to be transformed into action. Gupta and George (2016) provide a good grounding for explaining assets and capabilities belonging to BDA. They divide the concept of BDAC into tangibles, intangibles, and human skills. The tangibles are sub-divided into basic resources, data, and technology which are considered critical for success. Whether authors divided intangibles into two assets - organisational learning and data-driven culture - that are viewed as being important components in the effective deployment of Big Data initiatives. An organisation's human skills are referred to as the employees' experience, knowledge, business acumen, problem-solving abilities, leadership support, and relationships with others (Gupta and George, 2016). Arguably considering the combination of data (Big Data) and IT components generally would improve and will get a better basis for understanding in Big Data initiatives, however most of the studies that examine the effects of a firm's IT capability in relation to BDAC typically base their theoretical assumptions on the Resource-Based View (RBV) of the firm, which argues that competitive advantage emerges from unique combinations of resources that are economically valuable, scarce, and difficult to imitate. Thus, the existing literature mainly defines the principal resources that have an impact on the process of Big Data initiatives. Moreover, as pointed out by Wamba et al. (2015), the majority of publications in the field of Big Data capabilities are, not surprisingly, slanted towards *technical* aspects as the concept is increasingly viewed as a technology issue. However, since Big Data is a relatively new phenomenon, the nature of the Big Data required capabilities process requires searching, learning, and testing. Gupta and George (2016) note that data analytics does not tell the whole story, and organisations with higher organisational knowledge and different organisational capabilities will likely have an advantage when making decisions based on or supported by Big Data analytics results.

### *2.5.3 Marketing Capabilities for Big Data*

In addition to technological competencies and capabilities Bruni and Verona (2009) note the importance of marketing capabilities. They suggest that industries where firms compete on the basis of the adoption of new technology, such as Big Data with marketing capabilities, can create a source of uniqueness and rarity. Vorhies and Morgan (2005) highlighted that an organisation's marketing capabilities enable to convert its resources to valuable outputs to reach target customers and to orchestrate its resources to manage marketing information and develop its marketing strategy. Thus it has been suggested that in order to deploy new assets effectively, the organisation needs to develop sufficient market capabilities to transform them into valuable output (Morgan et al., 2009). In an extension of this notion, Bruni and Verona (2009, p. 7) propose the construct of dynamic marketing capabilities that reflect human capital, social capital, and the cognition of managers involved in the creation, use, and integration of market knowledge and marketing resources. The authors emphasise that these activities involve the processes of knowledge diffusion, social network building, the integration of market knowledge, and marketing resources in order to match and create market and technological change. In the case of Big Data, it implies to an ability of generating high quality knowledge regarding customers competitors, future market trends and transforming that knowledge into action to meet customers need (Danneels, 2010; Bharadwaj et al., 2013).

While resent research (Bruni and Verona, 2009; Borges et al., 2009; Danneels, 2010) in the field of technological innovation has acknowledged the importance of marketing capabilities in technological adoption few empirical studies have examined the role of market-related capabilities in the face of big data initiatives adoption. Marketing capabilities include all those activities involved in the acquisition of information about current and potential customers, which also includes dissemination of this information among different departments (Borges et al., 2009) also might need to be aligned with the changing condition when it come to new initiatives.

### *2.5.4 Dynamic Capabilities for Big Data*

Helfat et al. (2007) note the firms that lack understanding of their operational capability reconfigurations will struggle to align their capabilities to new initiatives. Thus, DC, which promote high evolutionary fitness, enable firms to survive and grow in response to changes in the external environment, including customer demands and corporate strategy priorities (Wilden and Gudergan, 2014). Therefore, DC have grown in importance as the expansion of trade has led to more rapid competitive responses (Teece, 2012). To make Big Data initiatives work, there is an enhanced need for businesses to develop and maintain new asset alignment capabilities that enable firms to combine Big Data with existing resources and capabilities so as to deliver value to customers. Teece (2012) further suggests that if the firm aims to sustain itself as markets and technologies change, three clusters of DC's activities such as: (1) identification and assessment of an opportunity (sensing); (2) mobilisation of resources to address an opportunity and to capture value from doing so (seizing); and (3) continued renewal (transforming) must be performed in a highly skilful or knowledgeable manner. With organisations immersed in data (Davenport et al., 2012), it has become essential that they develop organisational capabilities - both operational and dynamic - to take advantage of this huge heterogeneous flow (Bharawaj et al., 2013). However, while some academics (Boyd and Crowford, 2012; Davenport et al., 2012; Bharadwaj et al., 2013; Buhl, et al., 2013; Ekbia et al., 2014) see a diversity of opportunities and challenges regarding Big Data, practitioners are desperately trying to make sense of their own practice. Therefore, understanding Big Data as a strategic resource that requires organisational capabilities for its successful implementation is fundamental to this study. However, while establishing the importance of different capabilities, the questions of whether companies have such capabilities, and/or how they develop them in the case of Big Data remain unanswered.

In general it has been suggested (Boyd and Crowford, 2012; Bharadwaj, et al., 2013; Davenport, 2012), that the five Vs of Big Data are the main challenges for Big Data management. However, these five dimensions are complementary to each other, and as one dimension changes, there is a tendency for the others to change too (Laney, 2001; Gandomi et al., 2014; Haider, 2014; Hallman et al., 2014). This makes Big Data more complex than those digital data held and dealt with by companies in the past. It brings various challenges for companies attempting to leverage this new resource to their advantage.

## 2.6 Capabilities and Dynamic Capabilities for Big Data in the Pharmaceutical Industry

As discussed earlier in this thesis (Section 1.2.2; Section 2.2.2), Big Data initiatives in the pharmaceutical sector are driven by the aims of achieving personalised medicine programs that will significantly improve patient care (Kumar, 2011; Costa, 2014), reduce the time taken to bring a candidate drug to market (Taylor, 2015) and reduce production costs (Paul et al., 2010; Ernst and Young, 2014). However, regardless of the predicted impact of Big Data on different operations and other areas of the business, large and complex data becomes difficult to handle for traditional data processing applications and existing capabilities in Big Pharma. Thus, Big Data is triggering the development of new applications and capabilities in the sector, including capabilities for Big Data in the management of R&D and clinical trials and in the process of gaining regulatory approval, as well as in the areas of Marketing and IT (Costa, 2014; Harvey et al., 2012).

### *2.6.1Marketing capabilities for Big Data in the Pharmaceutical Sector*

Traditionally, pharmaceuticals have been characterised by significant heterogeneity in terms of the organisations' marketing orientations and innovative capabilities (Galambos and Lamoreaux, 1997). Pharmaceuticals have made substantial investments over many years to understand market opportunities, develop compelling marketing strategies, and optimise sales force deployment to ensure the successful launch of a new product (Taylor, 2015). These investments have generated billions of dollars of value for shareholders and helped save thousands of patients' lives (Sadat et al., 2014). However, while the pharmaceutical sector has traditionally enjoyed considerable growth as a result of its marketing and production capabilities, today's competitive environment and Big Data initiatives demand a fundamental change to the way organisations do business (Coombs and Metcalfe, 2002). Recently Sadat et al. (2014) found that the existing integrated operational model in the pharmaceutical sector is becoming unsustainable. This is due to a range of internal and external forces, such as: internal and external market forces (e.g. payers, like patients and health insurers), advances in technology, and government policies (e.g. healthcare reforms and drug price controls). A shift is required from the current functionally-divided approach to a data science-enabled approach that takes advantage of ongoing digital innovation (Marwaha et al., 2018). In addition to these cross-functional interactions, the relationships among global, regional, and local marketing groups in the digital age can also harm performance if not carefully orchestrated and managed (Teece, 2007). Thus, not surprisingly, the need to identify and build new marketing and IT capabilities for Big Data initiatives has become essential for Big Pharma to compete effectively in this new, digital environment (Groves, 2013).

Although Big Pharma is being driven by a changing digital environment to form bridges with the scientific, technological, and marketing forces through various responses (e.g. using genomics in their product development) to deliver value to patients (Sadat et al., 2014), the success of Big Data initiatives is still in its early stages within MNCs in the pharmaceutical industry. While some solutions are proposed, there are only a few tangible examples of how companies are addressing one of the industry's one of pressing issues - how they will prepare for Big Data adoption and develop required capabilities (Deloitte, 2014). Some studies (Costa, 2014; McKenzy, 2014 ) indicate that the pharmaceutical industry remains heavily reliant on traditional research techniques and has been slow to follow the example of other industries (e.g. retailers, financial) in employing innovative techniques to generate deep insights from Big Data initiatives (Costa, 2014; McKenzy, 2014). For example, even though improved technology has allowed for better-targeted design, which has meant that patient needs have become a more important driver in drug discovery, many pharmaceutical brands are still using behavioural and demographic (e.g. prescriptions written) segmentations instead of what is termed '*needs-based segmentation*' (Greengrove, 2002 ). This is a process of segmenting the market based on understanding the needs of the end user - needs which can be met by the products and services available. Using this new method of segmentation can help pharmaceuticals demonstrate concentrated value and gain reimbursement at a good price in certain distinct market segments (Smith, 2010).

Smith (2010) defines a value proposition as '*The complete offer made to, and as seen by, the customer, including all its costs, benefits, experiences, and risks'*. It is becoming increasingly challenging for Big Pharma to use traditional approaches to develop value propositions (e.g. innovations, services, or features intended to make a product attractive to customers) in the digital age (Ernst and Young, 2014). Once a company has defined its target segments (e.g. physicians, patients, or others) it is important that it also develops segment-specific value propositions.

Currently, regulators and other gatekeepers in the industry explicitly request that manufacturers supply specific evidence (by segment) to enable them to make decisions on whether to register new products, or whether to reimburse them and, if so, at what level (McKenzy, 2014). So developing value-added services to targeted segments (e.g. cooperative marketing programs, patient education programs, and patient loyalty programs) is important for personalised and reimbursed medicine. In addition, customer satisfaction is increasingly important because it is being monitored by state and federal government groups and published by organisations such as the Consumers Union (Shah and Pathak, 2014). Moreover, it requires loyalty which is brought about by trust, superior service, and, to varying degrees, personalisation (Abbot, 2006). Consequently, demonstrating value to stakeholders is probably the most important aspect of Big Pharma's marketing today that needs to be developed to the same extent other additional capabilities (Smith, 2010; McKenzy, 2014).

It has been suggested that, to improve targeting activities, companies can combine patient insights with data from different sources (McKenzie, 2014). For example, integrating additional data about the patient and his or her environment might provide better predictions and help target interventions to the correct patients. Presumably, these data may enhance the understanding of the effects of consumer behaviour, which in return may affect the way companies design their benefits packages (Smith, 2010). Thus, while Big Data offers great potential for revolutionising many aspects of the marketing operations of pharmaceutical firms, it has also been suggested that the ability to access new knowledge from out with the boundaries of the organisation and to integrate new knowledge flexibly across disciplinary and therapeutic class boundaries within the organisation is also particularly important (Henderson and Cockburn, 1994). However, it has been acknowledged that prior to this pharmaceuticals will need to improve the quality of their internal data management and IT capabilities (Shah and Pathak, 2014). This is mainly as a result of data traditionally being used narrowly, within individual functions and for specific purposes, such as trial design, patient recruitment, pricing, and marketing.

The recent trend toward using data derived from real-world outcomes to inform marketing activities creates the need for closer coordination between different functions and stakeholders – meaning that companies must rethink core business processes (such as drug development and commercialisation) and seek new ways to increase their productivity (Kumar, 2011; Costa, 2014). Thus it has been suggested that by using dynamic capabilities, businesses can become adaptable and escape unfavourable path dependencies in a rapidly changing environment (Teece, 2007). However, there are few examples in the academic literature relating to how MNCs in the pharmaceutical industry face such challenges by using their dynamic capabilities to prepare for Big Data adoption.

### *2.6.2 IT Capabilities for Big Data in the Pharmaceutical Sector*

As we have seen, the vast amounts of various types of data (e.g. insurance claims, medical records, images from patient scans and so on) that are generated around the pharmaceutical industry can be exploited for their value in marketing and other operational activities. In addition, there is a need for technology that is able to handle and support the analytical processing of these fast-moving data (Gupta and George, 2016). The rapidly-growing body of potentially valuable information hidden in such volumes of data requires improved computational infrastructure (e.g. storage), new methods to interpret and transfer the data (e.g. use of new software to analyse the data without losing information), and collaborative approaches (Costa, 2014). Thus, as in many other sectors, computational solutions (such as cloud-based computing) have been considered to be a new way to store, analyse and transfer data generated by different devices (McKenzy, 2014). For example, cloud computing has been proposed as a storage model that can provide the elastic scale needed for large-scale storage, as in the case of DNA sequencing. However, in addition to improved computational infrastructure, Harvey et al. (2012) and Shah and Pathak (2014) suggested that, for personalised medicine, the key factors in the development of suitable IT capabilities are instead data standardisation, integration, and harmonisation. For example, tools and processes for data collection and analysis must be standardised across research sites, while research activity at different sites must be integrated to maximise synergies (Shah and Pathak, 2014). However, to produce standardised data that will accelerate research, there is a need to harmonise the way in which data are collected, checked for accuracy, and stored (Harvey et al., 2012). Furthermore, Harvey et al. (2012) suggest that harmonisation will help to improve communication between different functions and in other areas impacting on personalised medicine. Such developments will help Big Pharma to move from a functionally divided approach to a data science-enabled approach.

### *2.6.3 Dynamic Capabilities in the Pharmaceutical Sector*

The successful implementation of Big Data initiatives demands the creation and coordination of new systems and, in some cases, the reconfiguration of the traditional operational (marketing and IT.) capabilities of large pharmaceutical companies (Coombs and Metcalfe, 2002). The creation, coordination (e.g. cross-disciplinary and cross-functional specialisations) and reconfiguration of existing capabilities has been assumed to be of increasing importance to this sector, alongside other dynamic capabilities such as: sensing and seizing new opportunities (Groves, 2013, Marwaha et al., 2018), consuming technological changes through learning processes (reconfiguration) (Costa, 2014; Sadat et al., 2014), and dynamic marketing capabilities (Bruni and Verona, 2009).

The threats and opportunities associated with Big Data have organisational implications that require senior managers to be able to attend to, sense, and seize those opportunities that may help their organisations build a data-driven competitive edge (Groves, 2013). This is mainly because these abilities determine the speed at, and degree to which, particular resources and capabilities can be aligned and realigned to match the requirements and opportunities of a changing business environment (Teece, 2012). Furthermore, Levinthal and March (1994) stated that the degree to which firms learn about new opportunities is a function of the extent of their participation in such activities. Consequently it is clear that all of these changes, set against the current global backdrop of digital transformation and business acceleration, have led to a growing need for industry leaders in Big Pharma to learn and adapt, where *learning* in this case involves an organisation improving its day-to-day processes and learning how to incorporate Big Data analytics into those processes (Teece, 2007).

Although suggestions have been made about how pharmaceuticals can approach Big Data initiatives, there is a tendency for pharmaceutical companies to avoid overhauling their entire data-integration system at once because of the transformation challenges and costs involved. Perhaps this can explain why there are so few empirical insights into how the theory behind Big Data and required capabilities development compares to such initiatives being at work in practice. However, although still in its early stages, Big Pharma's effort to adopt new technologies continues to accelerate in the industry, as do the opportunities to embrace insights from Big Data (Groves, 2013; Costa, 2014; Wang et al., 2018).Thus, these offer an valuable opportunity to study how Big Data initiatives and required capabilities development are approached in practice in the pharmaceutical industry, given their growing importance for the industry and the overall global economy (e.g. Brynjolfsson et al., 2011; McAfee et al., 2012; Wamba et al., 2015; Mikalef et al., 2017).

## 2.7 Research Gap

Adopting the dynamic capabilities perspective, the purpose of this research is to generate knowledge on the process of Big Data adoption within a pharmaceutical company. To achieve this purpose, an investigation is needed on how companies perceive Big Data, and what capabilities they employ to integrate it within their company strategy in order to extract the most value from such an initiative.

Despite the great interest surrounding Big Data, exploiting its potential value has still not yet been fully developed or examined (McAfee et al., 2012). Much attention to date has been on the technical aspects of Big Data, such as storing, securing, and analysing the ever-increasing volumes of data obtained by organisations. The literature review in this chapter shows that the current literature is still at a developmental stage in terms of explaining how organisations, in particular MNCs in the pharmaceutical industry, realise value from Big Data. Examination of this shortfall is the core of this study.

Even though there are acknowledged opportunities and challenges associated with Big Data initiatives in the pharmaceutical sector, there are few examples in the literature of why and how MNCs prepare for Big Data adaption in practice and what are obstacles they face during this journey. Consequently, there is a limited academic body of knowledge on the organisational capabilities that Big Data exploitation encompasses in pharmaceuticals and how they can be developed to gain full benefit for the industry (Brynjolfsson et al., 2011).

As with any new technology, it is important to understand the mechanisms and processes through which Big Data can bring business value to companies. Thus, a major discussion over the years has focused on the opportunities and challenges that Big Data brings to organisations (Chen et al., 2012; McAfee et al., 2012; Davenport et al., 2012). However, there is less empirical evidence in the literature relating to how MNCs in pharmaceuticals can overcome these challenges. Although suggestions exist that Big Pharma needs to change, renew, and innovate its capabilities, and/or fundamentally change existing operational models and enhance internal data management capabilities (Deloitte, 2015; Teece, 2010) successful Big Data initiatives are still rare within MNCs in the pharmaceutical industry, despite their access to resources, market knowledge, and key technologies. Thus, it is not clear what are the required capabilities that pharmaceuticals need to develop for Big Data initiatives.

Agarwal and Dhar (2014. p. 445) looked at challenges and opportunities pertaining to Big Data in information systems research and noted that the Big Data phenomenon expanded opportunities for inquiry into any type of phenomenon researchers may want to study, ranging from all functional areas of the business to the broadest perspective on the enterprise as a whole. However, it is important to consider and bring new insight into how the different pieces fit together. Various authors suggest that research on today's data-rich environment should be more focused on business transformation and value creation through data, and less on algorithms or frameworks without consideration of business value. Adding to this conversation, it is clear from the literature (Bharadwaj et al., 2013; Constantiou and Kallinikos, 2015; Erevelles et al., 2015; Wamba et al., 2015) that some current predictions offer valuable ideas about how MNCs in pharmaceuticals might approach Big Data initiatives, although these ideas need to be explored for greater insight, without being limited to existing knowledge and practices.

It has also been acknowledged (Chen et al., 2012; McAfee et al., 2012; Davenport et al., 2012; Galbraith, 2014; Gandomi et al., 2014) that Big Data transforms the way that companies relate both to their customers and to the way the companies enact and perform business operations. The growing interest in Big Data, however, means there is a need to explore how it can be exploited within organisations. Constantiou and Kallinikos (2015) note that decision-makers have a limited understanding of how to adopt and implement Big Data initiatives that can drive their business strategies. Potential adopters also are struggling to make key decisions in relation to Big Data. For example, recent findings from Woerner et al. (2015) show that many chief information officers (CIOs) and business executives have hesitated to make major investments in Big Data, specifically after direct experience of disappointing results, or observing other firms failing in Big Data investment. Therefore, some industries, including Big Pharma, remain heavily reliant on traditional research techniques and have been slow to follow the example of other industries (e.g. retail, financial) in employing innovative techniques to generate deep insights from Big Data initiatives (Costa, 2014; McKenzy, 2014). This justifies a call for further empirical studies that carefully examine how MNCs in pharmaceuticals actually prepare for Big Data adoption in practice and how a company may strategically approach the issues of using Big Data. For example, there is a need to investigate how MNCs in the pharmaceutical industry identify and develop their capabilities for Big Data. Specifically, future research needs to empirically examine how different resources and capabilities within organisations work with Big Data in practice.

While acknowledging the importance of investment in the improvement or development of capabilities, there are differences between competitors in the timing of this kind of effort, and in the amount of investment, in the managerial undertakings, and in the internal organisational culture that supports this process (Kale et al., 2002; Ethiraj et al., 2005). It is also assumed that organisations take different positions when it comes to implementing Big Data initiatives, such as industry context, organisational size, and the business environment. The nature of the pharmaceutical industry, coupled with the fact that most of Big Pharma consists of MNCs (Schotter and Beamish, 2011), perhaps differentiates pharmaceutical organisations from those who have achieved success in Big Data adoption. There is thus increased demand for more empirical approaches that look at what new capabilities MNCs in pharmaceuticals develop for Big Data and how they develop it in practice.

The overall findings from the literature (McAfee and Brynjolfsson, 2012; Davenport et al., 2012; Chen et al., 2012; Wamba et al., 2015) suggest that managers can realise great benefits from establishing a Big Data-driven culture and capabilities. Indeed, Big Data as a resource in a vacuum is meaningless. To uncover hidden patterns within data, organisations need to develop capabilities around it. Capabilities and organisational processes are interlinked, as it is the capability that enables the operational activities in a business process to be carried out (Day, 1994). With the correct capabilities in place, a firm can better adapt to the digital environment, and make better use of Big Data for its operational activities (Marketing and IT.). Ethiraj et al. (2005) argue that while a resource like Big Data is available to all firms, the capability to exploit it effectively is not uniformly distributed. To meet Big Data requirements there is a need for the enhancement of existing capabilities, or investment in developing new capabilities.

Although dynamic capabilities (organisational and managerial abilities) have been acknowledged as a possible tool to enhance organisations' existing capabilities, they are mainly investigated and explored in the context of an organisation's performance. There is a limited body of knowledge on their role in the capabilities development process, especially in the context of Big Data. Moreover, Teece (2012) argues that although some elements of dynamic capabilities may be embedded in the organisation, the capability for evaluating and approaching changes to the configuration of assets rests on the abilities of senior management. However, there is only a limited number of studies that directly develop this topic, making it an obvious candidate for future research.

## 2.8 Chapter Summary

This chapter synthesised the existing literature that lays the theoretical and conceptual foundation for the investigation of this research. Furthermore, the chapter developed an argument for this thesis by appraising gaps and weaknesses in the existing literature, some of which are addressed in this research. Adopting the theoretical lenses of RBS and DC to examine the research problem identified in this chapter, the next chapter sets the theoretical framework for this thesis, to investigate the research problem and answer the research questions.

# Chapter 3: Conceptual Development

## 3.1 Introduction

Applying the Resource-Based View (RBV) and DC approach discussed in the previous chapter as a theoretical underpinning to this research, this chapter sets out a conceptual framework for an empirical investigation of the following research questions:

**1. Why did an MNC in the pharmaceutical industry prepare for Big Data adoption? RQ1**

and

**2. How did the company approach the issue of using Big Data and how did they identify and develop their capabilities for Big Data? RQ2**

  **I. What new capabilities did they develop?**

  **II. How did they develop these new capabilities?**

Big Data as an organisation's intangible strategic resource is conceptualised in the Resource-Based View (RBV) theory, while use of capabilities based on Dynamic Capabilities (DC) theories is used to reflect the dynamism of the digital environment and conceptualise the capabilities development process for Big Data.

## 3.2 The Conceptual Framework

As outlined in the previous chapter, the chosen RBV and DC theories look at the ways that resources can be better utilised to address the changing needs and requirements of a business. Furthermore, these theories focus on the organisational perspective, explaining the need for an organisation to address the rapidly changing business environment by developing required capabilities. The underlying assumption based on these theories is that the value from a new resource does not only arise from owning the resource but from how the resource is deployed and combined with existing competencies and capabilities. An organisation should have the ability to *'orchestrate'* their resources and operational capabilities in order to adapt to and evolve in a rapidly changing environment (Penrose, 1959; Teece, 2007; Ambrosini and Bowman, 2009; Barreto, 2010; Wade and Nevo, 2010). Within this definition Big Data can be viewed as a new resource to be combined with operational capabilities by a modern company in order for it to successfully operate in a rapidly changing environment.

As changes occur in the environment in a time of global markets and advances in technology (Pavlou and El Sawy, 2011) companies today must be alert and be able to respond to potential threats or opportunities by developing and using dynamic capabilities (Roberts et al., 2016). Teece (2007) suggests that, in such a rapidly changing environment, operational capabilities can provide an organisation with technical fitness but not evolutionary fitness. Thus, by using dynamic capabilities, businesses can become adaptable and escape unfavorable path dependencies, thereby achieving evolutionary fitness. Therefore, following the theoretical grounds discussed above, figure 3.1 below illustrates the conceptual framework for this research. Each box in the figure illustrates concepts that are adopted from the theoretical background and which are the subject of an empirical investigation of an organisation's digital environment (Box 1).

From left to right, Box 2 represents Big Data as a new intangible resource concept. Box 3 represents an organisation's existing capabilities (*operational* (Box 3.1) and *DC* (Box 3.2.). Box 4 demonstrates the development of new or enhanced capabilities in response to Big Data opportunities. Understanding these three concepts within an organisation's digital environment will help to evaluate how new or enhanced capabilities for Big Data are developed. Each concept is described in detail below.

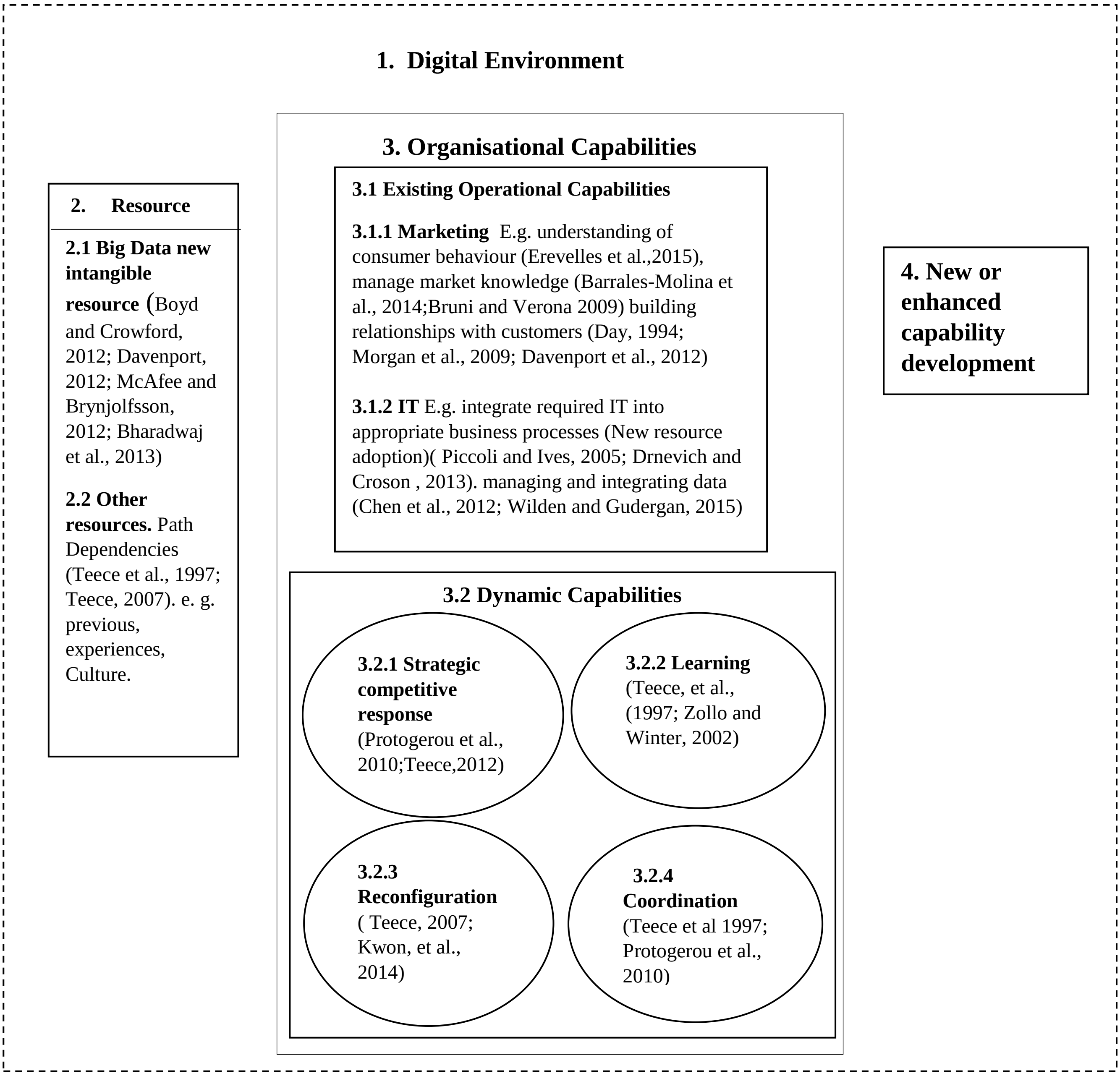



*Figure 3.1: Conceptual Framework (Authors own)*

### 3.2.1 Digital Environment (Box.1)

There is no doubt that today's fast-moving world of technological advances has unintentionally assisted the digital age in daily generating many gigabytes of business and personal data across various channels (George et al., 2014; Davenport, 2014; Wamba et al.,2015). Almost half of the world's population today is online, and many of them have become specifically mobile and online consumers (Gandomi et al., 2014) with consequent changes of their needs, behaviors, and demands. In addition, nearly all sizes and types of organisations have benefited from the rise of the Internet and the mobile revolution (McAfee and Brynjolfsson, 2011). In such an era, the importance of Big Data is rapidly becoming the norm (Manyika et al., 2011). However, organisations seeking to profit from Big Data in the evolving digital environment, which is characterised by a high degree of market and technological change, are now faced with a greater diversity of external factors than ever before (Chen et al., 2012). For example, it was evidenced in the literature (Sadat et al., 2014; McKenzy, 2014) that a range of internal and external forces alike, such as: internal and external market forces, regulatory bodies, advances in technology, and the availability of digital data are all currently driving Big Pharma to make fundamental changes. Therefore, investigating the consequences of the digital environment in the case of the adoption of Big Data initiatives within MNCs in the pharmaceutical industry would help to bring new insight into how and why industries such as pharmaceuticals are preparing for Big Data and how they are facing such challenges.

### *3.2.2 Big Data as a New Resource (Box. 2)*

The literature reviewed in the previous chapter (e.g. LaValle et al., 2011; Boyd and Crowford, 2012; Davenport et al., 2012; McAfee and Brynjolfsson, 2012; Bharadwaj et al., 2013; Buhl, et al., 2013; Gandomi, et al., 2014; Wamba et al., 2016) shows that the benefits and opportunities of Big Data as a digital resource brings with it additional dimensions that alter the nature not only of value creation but also that of the capture and distribution of business among competitors. The nature of Big Data and its dimensions (the 5 Vs) challenge the traditional ways of using and accessing data, resulting in increased demand for the development of new capabilities. Therefore, to create value from a new source organisations first need to understand and find ways of deploying it.

Much of the research to date (Setia et al., 2013; Bharadwaj et al., 2013; Erevelles et al., 2015) has demonstrated that Big Data and advanced technologies alone rarely provide direct value to organisations. Instead, these technologies are most effective when combined with a firm's other resources and capabilities. Teece et al. (1997) highlight the importance of path dependencies

(Box. 2. (2.2)) and the need to reconfigure a firm's resources and capabilities to enable the firm to change and evolve. Therefore, it is important to understand an organisation's intention for Big Data initiatives and its existing data management processes. Doing so will shed light on how an organisation renews or reconfigures existing capabilities to integrate and manage new resources like externally available large data sets (Big Data).

### *3.2.3 Existing Capabilities (Operational and DC) (Box. 3)*

In this research an organisation's operational capabilities are defined as an organisation's day-to-day ability to '*make a living',* or to convert inputs into outputs (Wilden and Gudergan, 2015) with input in this case referring to Big Data as a new resource (Box 2). It has been argued (Bharadwaj et al., 2013; Kiron et al., 2014) that one of the biggest ongoing challenges in the Big Data environment is that there is still no clear direction on how to reach business targets by aligning it with the existing organisational culture and capabilities. In the vein of academics (Pavlou and El Sawy, 2011; Wilden and Gudergan, 2015; Erevelles et al., 2015) who divide operational capabilities into marketing (e.g. market knowledge, customer relationships, and distribution channels) and technological (e.g. technical expertise and equipment) capabilities, for this research the Marketing and IT capabilities (box 3.1.1 and 3.1.2) have been identified as among the most important operational capabilities within the firm that governs a strategic process by adopting new resources, and which help the organisation evolve (Day, 1994; Grover, 2005; Morgan et al, 2009; Nevo and Wade, 2010; Protogerou et al, 2011; Erevelles et al, 2015). To put Big Data into action and to channel it into specifically directed initiatives, the literature (Costa, 2013; McKenzy, 2014; Wang et al., 2018) is clear that pharmaceuticals must have both marketing and IT capabilities, which are indispensable to the process of transforming Big Data resources into potentially competitive assets (Chen et al., 2012; Erevelles et al., 2015; Danneels, 2010). Organisations may view data as a primary business asset (Redman, 2008) in organisational sense, but it is the firm's IT function that is tasked with managing and integrating data as an enabler of data-driven business processes and decision-making (Chen et al., 2012).

On the other hand, an organisations' marketing capabilities allows it to capture rich and newly available sources of information (Big Data) that enable it to realise and strategically act upon new gaps in the firm's understanding of consumer behavior. However, it was also highlighted that in the new technological environment, Big Data (the rise of semi-structured and unstructured data) calls for *ad hoc* and real-time extraction, processing, and analytics, which increases the demand for a corresponding improvement in IT capabilities (Chen et al., 2012). In addition, it was evidenced in the literature (McKenzy, 2014; Costa et al., 2014) that the most important aspect of Big Pharma's marketing in today's digital environment – of demonstrating the value to stakeholders of personalised medicine - requires such developments to be put into effect. Therefore, these two operational capabilities are considered to be at the core of this study.

#### *3.2.2.1 Operational (Marketing and IT) Capabilities (Box. 3.1)*

***- Marketing Capabilities (Box. 3.1.1)***

In general, a firm's marketing capability is defined as the integrative process by which a firm uses its tangible and intangible resources to understand complex and specific consumer needs (Morgan et al., 2009. More specifically marketing capabilities are considered to be internal processes that allow organisations to become more market-driven (Liu and Ko, 2011). Barrales-Molina et al. (2014) believe that marketing capabilities have great potential to collect new market knowledge and disseminate it throughout the organisation. However, the authors also highlighted the need for more empirical studies to explain how marketing capabilities can manage such market knowledge, as well as how such knowledge promotes the renewal of an organisation's existing resources and capabilities.

Authors such as (e.g. Day, 1994; Dutta et al., 1999; Song et al., 2007; Krasnikov and Jayachandran, 2008) indicate that marketing capabilities include processes that are established within organisations (e.g. building sustainable relationships with customers, knowledge of the competition, and skills in segmenting and targeting markets) that aid understanding of customer needs through effective information acquisition, management, and use. The market knowledge thus generated should act as a driving force that allows the company to achieve a high level of process adaptation throughout the organisation as a whole (Bruni and Verona, 2009).

It was evidenced in the literature that processes mentioned above play significant roles in the management of Big Data within MNCs in the pharmaceutical industry. However, it was also recommended that pharmaceuticals will need to improve, reconfigure, or develop new marketing capabilities to effectively manage Big Data (Shah and Pathak, 2014). In particular, it was highlighted that the recent trend toward using data derived from real-world outcomes to inform marketing activities creates the need for closer coordination between different stakeholders, and for the improvement of existing targeting and segmentation activities (Kumar, 2011; Costa, 2014). Therefore, it is important to investigate these activities in practice.

- ***IT Capabilities (Box. 3.1.2)***

Along with marketing capabilities, the literature (Bhatt et al., 2005; Nevo and Wade, 2010) shows that IT capabilities are also competitive necessities, and their absence might result in a competitive disadvantage to companies. Piccoli and Ives (2005) note that an organisation's IT capabilities and IT strategic initiatives consist of identifiable competitive moves that depend on the use of IT to be enacted, and which are designed to lead to sustained improvements in a firm's competitive position (Porter, 1985). Examples of such activities include business process re-engineering, integration of required IT into appropriate business processes (Wilden and Gudergan, 2015), customer relationship management (CRM) (Payne and Frow, 2005; Coltman, 2012; Wang and Feng, 2014) electronic commerce, new resource adoption, and digital data management (Vitari et al, 2012).

In general, IT capabilities are defined as the ability of an organisation to assemble and deploy IT-based resources in combination with its other existing resources and capabilities (Bhardwaj, 2000). For example, Drnevich and Croson (2013) found that the importance of IT for the success of a business is significant as it directly affects the mechanisms through which a business creates and captures value. Furthermore, Drnevich and Croson (2013) also note that IT grants a firm the flexibility to focus on the rapidly changing digital environment and both enhances the organisation's current (operational) capabilities and the development of new capabilities. While IT capabilities are integral to operations at the functional level of the organisation they also play an important role in business-level strategy by enhancing existing non-digital capabilities while enabling new digital capabilities to create and capture value (Drnevich and Croson, 2013).

#### *3.2.2.2 Dynamic Capabilities (Box. 3.2)*

As related in the literature review conducted for this study, (Cepeda and Vera 2007; Protogerou et al., 2010; Wilden and Gudergan 2015; Braganza, et al., 2017) suggested that in a digital environment where technological innovation necessitates fast organisational responses to be made, dynamic capabilities become a tool that allows a firm to build and renovate operational capabilities faster and cheaper than its competitors. For example, Wilden and Gudergan (2015) note that when organisations face environmental changes even valuable marketing and IT capabilities can become liabilities, widening an organisation's capability gap. In such a case authors (Leonard-Barton 1992; Day 2011; Wilden and Gudergan, 2015) argue that dynamic capabilities become important because they reflect an organisation's ability to '*engage in market-based learning and use the learned insight to reconfigure existing resources and enhance its capabilities in a ways that reflects organisation's dynamic environment*' (Morgan 2012, p. 108).

This study conforms to the standard set by Teece (2007, p.1344) who defined dynamic capabilities as consisting of a series of managerial and organisational processes that 'orchestrate' the firm's resources and ordinary capabilities in order to adapt and evolve to rapidly changing environments. As illustrated in figure 3.1, Box 3.2, this research explores an organisation's managerial and organisational processes (strategic competitive response, learning, reconfiguration, and coordination) that are likely to better match the digital environment and make effective use of Big Data for their operational activities (Teece, 2007; Ambrosini and Bowman, 2009; Protogerou et al., 2010). Making connections between dynamic capabilities (strategic competitive response, learning, reconfiguration, and coordination) and operational (Marketing and IT) capabilities in the adoption of Big Data initiatives within MNCs in the pharmaceutical would help explain how the company prepared for Big Data adoption and how it identified and developed its capabilities for Big Data.

***-Strategic Competitive Response (Box. 3.2.1)***

Adopting the term *strategic competitive response* from Protogerou et al. (2010), whose definition incorporates sense, seize, and transformation abilities (Teece, 2007), this study holds that, as a core process of dynamic capabilities, strategic competitive response (box. 3.2.1) is particularly important in relation to the Big Data initiatives adoption process. Protogerou et al. (2010, p. 619) explain that strategic competitive response is the firm's ability to scan the environment, identify new opportunities, assess its competitive position, and respond to competitive strategic moves. In other words, strategic competitive response grants organisations the ability to *sense* new opportunities (Teece, 2007) offered by Big Data. The *seize* ability enables the mobilization of resources to address such opportunities and to capture value from doing so (Teece, 2007), and to maintain competitiveness through enhancing, combining, and reconfiguring (where necessary) an organisation's existing resources and capabilities (Teece, 2007).

Sensing is an important part of dynamic capabilities. The ability to sense threats and opportunities helps to identify new market opportunities, evaluate competitors, and recognise resource and capability gaps (Roberts et al., 2016). Therefore, it has a significant impact on a firm's capacity to redefine its operational capabilities for Big Data initiatives. The seizing ability is an equally important characteristic of dynamic capabilities that implies evaluation of various options to accommodate the identified opportunity (Protogerou et al., 2010). Thus, these abilities are important as they enables the firm to reconfigure (creating, extending, and modifying) certain capabilities before they become core rigidities (Teece et al., 1997; Eisenhardt and Martin, 2000).

Dynamic capabilities have an inherently transformative ability, in that they allow a company to adjust its capabilities in response to change (Wilden and Gudergan, 2015). To benefit from sensing and seizing activities, a company's asset orchestration must be reconfigured appropriately (Teece, 2007). In digital environments, where technological innovations are introduced by external sources, it is important to constantly scan and learn from the environment and to respond to detected changes. Thus, to look at how an organisation identifies, drafts, and carries out potential solutions in response to threats and opportunities that emerge from Big Data initiatives it is important for this study to explain how the company approached the issue of using Big Data and how it identified and developed its Big Data capabilities.

***-Learning (Box. 3.2.2)***

Organisational learning is defined as '*the capacity or process within an organisation to improve or maintain performance based on experience'* (Nevis et al., 1995, p 73). It has been argued (Teece, et al., 1997; Winter, 2003; Ethiraj et al., 2005) that capabilities reflect the evolutionary process of experiences that firms engage. Teece et al. (1997) suggest that learning is a very important process which through experimentation and repetition leads to quicker and better resolution of specific problems, and which at the same time enables firms to identify new opportunities.

Learning processes that promote, enhance, and renew technological knowledge are critical to the success of Big Data transformations in high-technology industries like Big Pharma (Helfat, 1997). This is especially true of sharing and combining new knowledge with existing skills and experience within an organisation, and cross-functional teams have been acknowledged to have a positive impact on the transformation and recombination of marketing and technological capabilities (Protogerou et al., 2010; Pavlou and El Sawy, 2011; Wilden and Gudergan, 2015). Therefore, examination of these processes will be important to this research.

***-Reconfiguration (Box. 3.2.3)***

The introduction of new resources like Big Data and advanced technology enhances a firm's efforts to use dynamic capabilities in order to reconfigure those operational capabilities that are most likely to support the ongoing development of valuable products and services. Reconfiguration is an organisation's ability to extend and modify existing capabilities in response to changes introduced in the market and technologies that are generated through new knowledge based on Big Data (Teece, 2007; Kwon, et al., 2014). It was evidenced in the literature that reconfiguration of existing marketing and IT capabilities was necessary for the MNCs in the pharmaceutical industry in order to implement Big Data opportunities in their operational activities. On the other hand, as has been explained several times in this thesis, in a digital environment the potential value of dynamic capabilities lies in enabling firms to renew and reconfigure their operational capabilities and introduce new configurations that better fit shifting environmental conditions. Therefore, looking at the reconfiguration ability is central to this study and its goal of explaining what new capabilities are needed for Big Data.

***-Coordination (Box. 3.2.4)***

Teece et al. (1997) suggest that efficient coordination of different resources and tasks may help an organisation overcome some of the challenges introduced by the digital environment. Moreover, one of the most suggested solutions for the Big Data transformation in the pharmaceutical sector was the coordination ability (e.g. cross-disciplinary and cross-functional specialisations). It was assumed that this capability would help Big Pharma to shift from the current functionally-divided approach to a data science-enabled approach to take advantage of continuing digital innovation (Marwaha et al., 2018). Protogerou et al. (2010) argue that coordination processes connect and interface single activities through communication, scheduling, task assignment, collaboration, and other related activities. This capability is an effective means of dealing with a changing business environment, especially in the case of Big Data, about which most firms have neither substantial experience nor established '*best practices*' to call on.

#### *3.2.4 New or Changed Capabilities in Response to Big Data Opportunities (Box. 4)*

While capabilities development may be enhanced by benefiting from a diverse range of inputs (resources, learning, experience) (Dosi et al., 2000; Eisenhardt and Martin, 2000; Zollo and Winter, 2002; Felin et al., 2012) this process is challenging and depends on many internal and external factors, such as project size, the level of hierarchy, and coordination (Rockart and Dutt, 2013). Taking together all the concepts as illustrated in the framework 3.1 and investigating them empirically would help to better explain connections between these concepts and arrive at new insight about which of them were adapted or innovated in response to Big Data opportunities.

The purpose of this conceptual framework is to provide an academic foundation for this thesis. The framework was developed based on an extended literature review and the research questions of this study. All the elements of the framework are extensions of established principles and represent key constructs in the research area. Implementing an empirical study and analysis of the resulting data would help to explain the connections between the concepts in the model and address the research questions.

Looking at the company's operational and dynamic capabilities which together constitute organisational capabilities (Helfat and Peteraf, 2003; Teece, Pisano and Shuen, 1997) will help to incrementally develop understanding and shed new light on the capabilities development process for preparation for and utilisation of Big Data initiatives in a pharmaceutical company.

As organisational capabilities are necessary for business transformation in the case of Big Data initiatives, investigation of capability possession, deployment, and the upgrading process for Big Data through the lenses of the RBV and DC theories is fundamental to this study.

## 3.3 Chapter Summary

Adopting the theoretical lenses of RBV and DC to examine the research problem identified in Chapter 2, this chapter positioned the Conceptual Framework (CF) for this thesis to investigate the research problem. The conceptual framework identified the following concepts: Big Data as a new resource; Existing Data Management Capabilities (Operational and DC) that are the subject of an empirical investigation in this research within an organisation's digital environment. In particular, operational (Marketing and IT) capabilities and DC (strategic competitive response; Learning; Reconfiguration; and Coordination) have been identified as the main concepts for the investigation. This conceptual framework guided a preliminary research set-up for the execution of the case study research and helped to define the research design and methodology that are discussed next in Chapter 4.

# Chapter 4: Methodology

## 4.1 Introduction

This chapter discusses the research design and methodology that were followed in the investigation of the research problem and in the fulfilment of the objectives of this study that were identified in the previous chapters. The purpose of the first part of this chapter is to explain the relationship between the ontological, epistemological, and methodological approaches (4.2) within the study and to justify how they collectively informed the choice of overall qualitative case study research strategy (4.3), the unit of analysis (4.4), the choice of empirical sample and data collection (4.5), and the ethical consideration (4.6). The second part of the chapter outlines the methods used for data analysis (4.7).

## 4.2 Research Approach and Rationale

Social science research is generally grounded around two methodological traditions - *qualitative* and *quantitative* methodologies, which define how researchers identify and gather certain kinds of data, along with the method or methods of analysing that data in order to appropriately address research questions. Each of these traditions is also further underpinned by philosophical foundations. A given research philosophy represents the researcher's guiding assumptions about the nature of the world (Easterby-Smith et al., 2008). The researcher's philosophical view about the nature of the world (ontology), how it operates, what they choose to study, and how they learn about it (epistemology) guide the research questions, methodological choices, and research activities (Crotty, 1998; Easterby-Smith et al., 2008). Different paradigms contain inherently differing ontological and epistemological views, and so make different assumptions about reality and knowledge. Traditionally, social science research has been approached from two contrasting philosophical traditions: positivism, which is usually referred to as the *quantitative* or *objectivist* approach, and social constructionism, also known as the *qualitative*, *subjectivist* or *interpretivist* tradition (Hussey and Hussey, 1997; Easterby-Smith et al., 2008).

Easterby-Smith et al. (2008) argue that understanding the philosophical issues of research design is of central importance for three reasons. First, knowledge of research design philosophy can enable the researcher to clarify what kind of evidence is required and how it is to be gathered, as well as providing answers to the basic questions being investigated in the research. Second, this knowledge can help the researcher to recognise which research designs will work and which will not. Third, this knowledge can help the researcher to identify, and even create, research designs which may be beyond the researcher's experience. Thus, identifying the most appropriate research ontology at the start of the research process is critically important as it determines the choice of research design. The next section will compare and contrast the different ontological and epistemological views to shed light on the rationale for choosing the *critical realism* approach (4.2.1) and the *qualitative* methodology (4.2.2) as the basis of this research.

### *4.2.1 Ontological and Epistemological Views*

#### *4.2.1.1 Ontology*

In social science, the term ontology refers to a researcher's view of the nature of reality, that is, the phenomena under investigation. Traditionally, there are two ontological perspectives in social science - *objectivism* and *subjectivism*. Objectivism is the philosophical assumption that reality or phenomena exist independently and externally to the researcher and the research population (Saunders et al., 2012). Contrarily, subjectivism is an ontological assumption that presumes that reality (or the phenomena being researched) are neither external nor detached from social actors or the researcher. Thus, subjectivism views reality as emergent and socially constructed, arising through the opinions of multiple social actors depending on their lived experiences (Bryman and Bell, 2011).

Considering that the main aim of this research was to explore why and how Big Data initiatives and required capabilities come about in a MNC in the pharmaceutical industry, the flexibility of the subjectivist approach offers the researcher an opportunity to study how various actors engage with Big Data initiatives in reality, through their potentially diverse views and experiences.

#### *4.2.1.2 Epistemology*

In general, three main epistemological views dominate the literature about the research process (e.g. Crotty, 1998; Easterby-Smith et al., 2008; Bryman and Bell, 2011): positivism, constructivism, and realism. The different views will be discussed below in terms of their underlying ontology, as well as the methods of enquiry and research methods associated with them.

**Positivism**. The fundamental philosophy of positivism is that the social world exists externally, and that its properties should be measured using objective methods, rather than being assumed subjectively by use of observation, reflection, or intuition. In investigating a phenomenon, positivism makes an ontological assumption that views '*reality*' in the study of a social phenomenon as external and objective (Easterby-Smith et al., 2008). A positivist epistemology implies that the goal of research is to produce objective knowledge that is neutral and unbiased, based on a view from '*the outside'*, without the personal involvement of the researcher (Willig, 2001).

The aim of research is to test a theory's claims in order to either reject the theory or to retain it for the time being. Therefore, theories are tested by deriving hypotheses from them, which can then be tested in practice, by experiment or observation (Willig, 2001). Thus, positivist epistemology is often partnered with the quantitative research strategy that emphasises quantification in the collection and analysis of data (Bryman and Bell, 2011).

**Constructivism**. By contrast, the philosophy of social constructivism assumes that reality is socially constructed, and is the basis of how people make sense of and view the world, especially through sharing their experiences. While positivists seek to uncover the truth, constructivists are critical of our ability to know reality with certainty (Trochim, 2006). The underlining ontology of constructivism rejects the idea of true and objective knowledge, since each of us experiences a different reality (Saunders et al., 2012; Trochim, 2006). However, this does not mean that we can never truly know something, but rather it suggests that there are '*knowledges*' rather than '*knowledge*' (Willig, 2001).

Because human experience, including perception, is mediated chronologically culturally, and linguistically, the same phenomenon or event can be described in different ways, giving rise to different ways of perceiving and understanding. Therefore, research from a social constructionist perspective is concerned with identifying the various ways of constructing social reality that are available in a domain, to explore the conditions of their use, and to trace their implications for human experience and social practice (Willig, 2001). For instance, many constructivist researchers believe that the best way to understand any phenomenon is to view it in its context and to become immersed in it. Thus, it can be best paired with a qualitative research strategy that, in contrast to a quantitative method, emphasizes words rather than numbers in the collection and analysis of data (Bryman and Bell, 2011).

**Realism** The philosophy of realism in general is defined by Phillips (1987, p. 205) as '*the view that entities exist independently of being perceived, or independently of our theories about them*'. In philosophical terms, realism could be regarded as a synthesis of positivism and constructivism. Its underlining ontology holds that while reality is real, all theories about the world are grounded in a particular perspective and worldview, meaning that all knowledge (epistemology) is necessarily partial, incomplete, and fallible (Willig, 2001).

According to Miles and Huberman (1994), a realist researcher thinks that social phenomena exist not only in the mind but also in the objective world and that some plausible relationships are to be found between them. There are two major forms of realism: Empirical Realism (ER), which believes that by using the appropriate methods reality can be understood, and Critical Realism (CR), which recognises the reality of the natural order and the events of the social world (Bryman and Bell, 2011). In contrast to Critical Realism, Empirical Realism fails to recognise that there are permanent structures; physical (e.g. atoms or organisms), social (e.g. the market or the family) or conceptual (e.g. categories or ideas) and generative mechanisms that underline and produce observable phenomenon and events (Bashkar, 1989. p. 2). Thus, Empirical Realism is usually identified as being equivalent to empiricism as it identifies the real with the empirical, that is, with what we can experience, as if the world just happened to correspond to the range of our senses and to be identical to what we experience (Sayer, 2000. p. 11). In other words, an empiricist recognizes only events which can be perceived, whereas for a Critical Realist only events that have a causal effect on the world can be said to exist, regardless of perceptibility. The concept of causality is a key difference between the two, referring '*to the relationship between an action or thing (cause) and the outcome (effect) it generates* (Wynn and Williams, 2012, p. 789) Critical Realism recognises the existence of a variety of objects of knowledge (e.g. material, conceptual, social, and psychological) each of which requires different research methods to be understood, as well as observation, especially in the social world (Mingers, 2004, p.100).

However, the concept of causality, and especially criteria for testing knowledge claims about causes, has been one of the focuses of criticism from adherents of the positivist approach towards CR. The positivist who attempts to 'explain' a phenomenon by hypothesizing a relationship between conceptual entities assumes a flat ontology that reduces reality to a Humean conjunction of cause with effect and has little regard for the mechanisms which link them (Joseph 1998). The Humean model of causation that relies merely upon correlations between observed events combined with statistical methods does not meet the explanatory criteria of CR (Lawson, 1997; Sorrell, 2018). Moreover, the positivist believes that CR lacks concrete guidelines to be followed when evaluating causal claims against each other, and questions the possibilities of detailed explanations without evaluating empirical evidence according to systematic and agreed-upon criteria (Mingers 2004). In other words, this criticism emphasises the lack of a systematic methodological tool to deal with (ontological) causal complexity that CR does not seem interested in providing.

However, from the CR perspective, a request for there to be fixed methodological criteria by which we can evaluate causal claims is unconvincing since such criteria are not appropriate in the social sciences, where the primary objectives of social scientific research are not to predict or to interpret but to explain (Sorrell, 2018). Within CR, causation is not based on regular successions of events or a correlational assessment of event regularities (Sayer 2000). CR instead shifts the focus to the explicit description of causality by detailing the means or processes by which events are generated by structures, actions, and contextual conditions involved in a particular setting. This view of causality is reflected in the ontological and epistemological assumptions upon which CR is founded, as well as in the methodological principles (Mingers et al., 2013).

In contrast to social constructivists, realism researchers do not believe that reality is structureless. Thus a realism approach allows for the use of quantitative as well as qualitative and hence can exploit the advantages of both. For example, Maxwell and Mittapalli (2007) state that a realist position is quite compatible with the key characteristics of qualitative research as it:

- ✓ Recognises the reality and importance of meaning, as well as of physical and behavioural phenomena.
- ✓ Emphasises the importance of the context of the phenomena studied, rather than seeking only a general understanding independent of specific conditions.
- ✓ Supports the importance of investigating the processes by which an event or situation occurs, rather than simply attempting to demonstrate an association between variables.

In addition, critical realism also seeks explanations for singular events and situations through case studies, rather than requiring that the explanation be based on observable patterns or '*general laws*' (Maxwell, 2004).

### *4.2.2 Rational for Choosing Critical Realism and Qualitative Methodology*

#### *4.2.2.1 Critical Realism*

The Critical Realism approach, which seeks to provide clear, concise, and '*empirically supported statements about causation*', especially for *how* and *why* enquiries (Wynn and Williams, 2012, p.789), is proposed as a means by which the researcher could investigate the research questions for this study, which seeks to identify why the MNC in the pharmaceutical industry prepared for Big Data adoption and how it identified and developed its Big Data capabilities. The research questions are consistent with the Critical Realism approach rather than the positivism approach that is associated with producing objective knowledge based on facts but without the personal involvement of the researcher (Willig, 2001), or the constructivism approach that – in contrast to positivism - is associated with subjectivism in that it rejects the idea of true and objective knowledge, since each of us experiences a different reality (Saunders et al., 2012).

The Critical Realism approach formulated by Bhaskar (1975, 1989) has been acknowledged as one of the most commonly accepted models in qualitative research (Bryman and Bell, 2011, p. 17). The approach partners a realist ontology with interpretivism to provide new perspectives for developing knowledge (Volkoff et al., 2007; Easterby-Smith et al., 2008). The real promise of the Critical Realism approach lies in its potential to allow researchers to identify the specific causes of the events under study. Beyond simply providing statistical evidence that a causal relationship exists, the critical realist shifts the focus to explicitly describing causality by detailing the means or processes by which events are generated by structures, actions, and contextual conditions involved in a particular setting (Winn and Williams, 2012). Thus, the explanatory power of the chosen approach, rather than the use of flawed and possibly biased reasoning alone (Pawson et al., 2005; Winn and Williams, 2012) allowed the researcher to examine multiple realities.

A key aspect of the CR approach is the stratification of reality into three main domains (Bhaskar, 1975), as shown in table 4.1

| | **Real** | **Actual** | **Empirical** |
|---|---|---|---|
| **Mechanisms / Powers** | ✓ | | |
| **Events and Behaviours** | ✓ | ✓ | |
| **Experiences** | ✓ | ✓ | ✓ |

*Table 4.1: A Stratified View of Reality (adapted from Bhaskar (1975, p. 41))*

According to Bhaskar (1975; 2010) understanding and then changing the social world are only possible by identifying: (1) underlying structures and mechanisms that generate events and discourses (Real domain), (2) events and behaviours that may (or may not) occur (Actual domain) and (3) experiences that we can (or cannot) experience (Empirical domain). Baskar (1975) argued that because social actors operate within social structures that feature institutionalised positions and practices, these actors obtain abilities from unequally distributed resources. Thus, relationships between different social structures tend to generate specific social behaviours and events. These relationships are termed *generative* mechanisms. Mechanisms are ways of enacting things, or of enabling or limiting what can happen within a given context (Bashkar, 1975, p. 14; Smith, 2006). The occurrence of generated events and behaviours can be *observed*, rather than merely *perceived*, in the actual domain, while such events and behaviours can be said to be *experienced* in the empirical domain.

In the context of this thesis, this stratified view of reality helps to describe what organisational/managerial processes are *able* to do in the case of Big Data initiatives (their real mechanisms, causal powers or tendencies); what they *actually* do (their impact on events in actuality), and the partial view of events available to the researcher (through sensory experience in the domain of the empirical). Based on the literature review in Chapter 2, it can be argued that the development of required capabilities for Big Data refers to the unconditional potential of organisational and managerial abilities (dynamic capabilities) in the domain of the real; to processes that refer to the realised activities of dynamic capabilities in the domain of the actual, and to the perceived nature of events held by managers (participants) that are rooted in the domain of the empirical.

#### *4.2.2.2 Qualitative Methodology*

Rather than relying on quantitative methods, which often involve large surveys that are rigorous in terms of theory testing and generalization (Hewege and Perera, 2013), the qualitative research strategy that was adopted enabled the researcher:

I. To understand the practical issues that the case study company was facing in developing Big Data capabilities in the challenging digital environment.

and

II. To examine and explore processes that enabled the company to adopt Big Data practices effectively.

Qualitative methods, allied with the CR approach, were also of greater relevance than quantitative methods would have been because they enabled greater practitioner engagement, which consequently helped identify and describe structured interactions between the complex phenomenon of Big Data and the required capabilities development processes.

As suggested by Bryman and Bell (2011), people and their institutions cannot be studied in the same way that other objects in the physical world are studied. When research intends to investigate capabilities, abilities, values, perceptions, and motivations – in other words, the factors that explain human behaviour – then the research should ask questions and collect data in the form of words rather than numbers. Words can yield valuable insight into the motivations behind the adoption of Big Data initiatives, whereas figures would give a detached account of behaviour patterns without insight into the reasoning that underlay it (Brayman and Bell, 2011). Therefore, a qualitative approach was judged to be most appropriate for this study, fostering as it does a better understanding of the lived experiences of the participants and their perceptions of how they prepared for Big Data adoption and developed required capabilities.

One particular criticism that can be levelled at qualitative research is that when these kinds of details are available - such as the first hand experiences, or perceptions - it can be hard to determine what the generalisable themes may be. However, the aim of this research, as in the case of many qualitative researchers rooted in the CR approach, is about generating rich descriptions of phenomena that explain, identify, and verify the existence of sets of mechanisms which are theorised to have generated the phenomena under study (Winn and Williams, 2012). Indeed, one of the most important purposes of good qualitative research is to create new ways of understanding processes by discovering or tailoring new concepts and theories that have both originality and utility (Corley and Gioia, 2011).

## 4.3 Choice of Research Method

### *4.3.1 Rational for Choosing a Case Study Methodology and its Research Methods*

This section seeks not only to provide the rationale for choosing a case study methodology for this research, but also to provide greater understanding of this method. While a specific recommended research methodology for the CR approach does not exist, several critical realism researchers, especially in the IS research domain, have identified the case-study method as the best approach to explore the interaction of structure, events, actions, and context to discover and explain causal mechanisms of the events in question (Miles and Huberman, 1994; Morton, 2006; Volkoff et al., 2007; Bygstad, 2010; Easton, 2010; Winn and Williames, 2012). Wynn and Williams (2012, p. 803) for example suggest that the case study is the '*primary research design in critical realist paradigm'* as it allows the in-depth explication of the causal mechanisms in operation in specific contexts. Thus, the case-study methodology makes it possible to examine phenomena in their complexity, without reducing the object of the research to just a few variables (Yin, 2003). This method '*involves investigating one or a small number of social entities or situations about which data are collected using multiple sources of data and different techniques for collecting data*' (Easton, 2010 p. 119). Therefore, conducting a case study was considered to be the most appropriate research strategy to achieve the research purpose and objectives for this study. Arguably, a deep empirical examination of the precise, real-life context in which the researched phenomena occur can deliver insight and contribute to knowledge (Yin, 2003). However, some aspects of case-study research had particular relevance and influence in the justification for a qualitative case-study strategy for this research.

**Firstly:** With consideration to the CR approach, in which research seeks to explain how and why specific, complex events occur in a particular context, the research question must ask about the causes of specific events, instead of merely describing the events in theoretical terms, testing existing theories, or proposing a predictive model. As a result, this research is targeting the *how* and *why* questions associated with explanatory case research (Wynn and Williams, 2012). Considering that the context of this research is to '*illuminate key features of explanatory issues*' Gray (2014, p. 267) of the capabilities development process for Big Data initiatives, it would be difficult to capture and explain the true causes of such an initiative without considering and investigating the context within which it took place. Therefore, the research context (the global pharmaceutical company), and more specifically the company's Big Data adoption project setting, in which the company's Big Data capabilities were developed and put to use, was considered the most suitable focus of the investigation, of how the company approached the issue of using Big Data strategically and how it identified and developed its capabilities for Big Data.

Organisational processes, systems, and structures were thought to be the best starting point to identify the organisational/managerial activities and processes (operational and dynamic capabilities). This was chiefly because of the well-acknowledged fact that capabilities are routines and processes that depend on managerial activities, practices, and which remain hidden until exercised (Teece, 2007; Easterby-Smith et al., 2008; Danneels, 2010). Moreover, it is '*not just how one plays the game; it is also a function of the assets that one has to play with and how these assets can be deployed and re-deployed in a changing market*' (Teece et al., 1997. p. 529). This is consistent with the CR paradigm that states that what should count as an adequate explanation of a phenomenon does not depend entirely on the nature of that phenomenon and/or on the current state of relevant theory, but also depends on the particular purposes for which, and the context within which, the explanation is being developed (Pawson and Tilley, 1997. p. 69). Hence, as Yin (2003, p. 13) states the case-study approach is ideal for '*investigating contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not evident*'. This is true of the case under discussion, of the phenomena of Big Data and the development of required capabilities. Thus, the case-study approach was believed to be the best way to uncover a relationship between the development of required capabilities for Big Data and the context in which it occurred, by focusing on the experiences, abilities, and knowledge of a variety of professionals trying to make use of Big Data and develop required capabilities in the real-time context of global pharmaceutical company. Reflecting on the personal experiences of people working within a Big Data project helped to provide a first-hand insight to practical issues, such as how the company approached the issue of using Big Data strategically, and how it identified and develop its capabilities for Big Data (Chapter 5 and Chapter 6).

**Secondly:** One of the benefits of a case-study approach is that a theoretical/conceptual position can be developed in advance of the study, in order to assist and direct data collection and analysis (Gray, 2014). Since qualitative enquiries are typically oriented towards grounded theory development in the case of many qualitative studies, a theoretical framework may not be articulated upfront. However, Baxter and Jack (2008) state that conceptual frameworks for case study designs developed beforehand can increase the feasibility of the completing the project, as it gives the researcher flexibility to manage the limits of the scope of the study to meet the timeframe of the research. A conceptual framework like this that had been prepared before the data collection began (figure 3.1) was synthesised from a number of related concepts (digital environment, Big Data, operational capabilities, dynamic capabilities) and was based on an inductive approach to the literature review, with both theoretical and empirical perspectives guiding the researcher throughout the research stages: data collection (4.5), data analysis (4.7), and structuring the findings and discussions (chapter 5 and 6).

**Thirdly:** The case selection - typically, case study research focuses on an intensive examination of events occurring within a single structure, such as an individual company (Bygstad, 2010), or a composite structure, such as multiple divisions (Morton, 2006) or sites (Volkoff, et al., 2007) within a firm. However, the selection of a case usually reflects the existence of events which are representative of the phenomena a researcher is attempting to explain (Wynn and Williams, 2012).

***-The Research Context of This Study. The Case Study Company***

The empirical context of this study is a $13 billion revenue, integrated, global multinational Pharmaceutical Corporation headquartered in New Jersey, USA, whose mission is to discover, develop, and commercialise innovative therapies for the treatment of cancer and inflammatory diseases through next generation solutions in protein homeostasis, immuno-oncology, epigenetics, immunology and neuro-inflammation. With more than 6,500 employees based in over 50 countries including Europe, Latin America, Middle East, Asia/Pacific, and Canada, the company has a strong presence in the worldwide markets, working with a variety of affiliates, franchises, partners, and distributors. Both the company's international headquarters and a drug product manufacturing facility which performs formulation, encapsulation, packaging, warehousing, and distribution are located in Switzerland.

Hundreds of clinical trials take place at major medical centres worldwide evaluating compounds from the company, and the company's medicines are available in more than 70 countries. The company's therapeutic products are subject to rigorous preclinical testing and clinical trials and other pre-marketing and post-marketing approval requirements of the FDA and regulatory authorities in other countries. Review and approval procedures outside of the United States are undertaken in virtually every other country comprising the market for the company's products. The approval procedure and the time required for approval vary from country to country and may involve additional testing. In certain countries such as the EU countries, and in Canada and Australia, regulatory requirements and approval processes are similar to those in the United States, where approval decisions by regulators are based on the regulators' review of the results of clinical trials performed for specific indications.

In most countries, companies promote their products through their own sales organisations under mandatory risk-management distribution programs tailored to meet local authorities' specifications to provide for their safe and appropriate distribution and use. According to the case study company's internal 2016 survey, over 500,000 patients were treated with the company's medicines around the world, while more than 293,000 patients received patient support, including disease education and health-system navigation, through the company's patient support programs. Across Europe, the company provides support to organisations and initiatives that make a positive impact on its patients and their communities. Support for patient organisations in Europe is the responsibility of the company's local office in the country in which the patient organisation is based and is dependent on local laws and regulations. Patient organisations who provide services in European countries are accountable to the company's (EMEA) international headquarters.

As a result, over the years the company's focus on using its products and innovations to deliver value to patients - defined as improved health outcomes and quality of life - has been especially evident in the case of multiple myeloma, where the company played a lead role in bringing forward significant advancements in patient outcomes, as Figure 4.1 below illustrates:

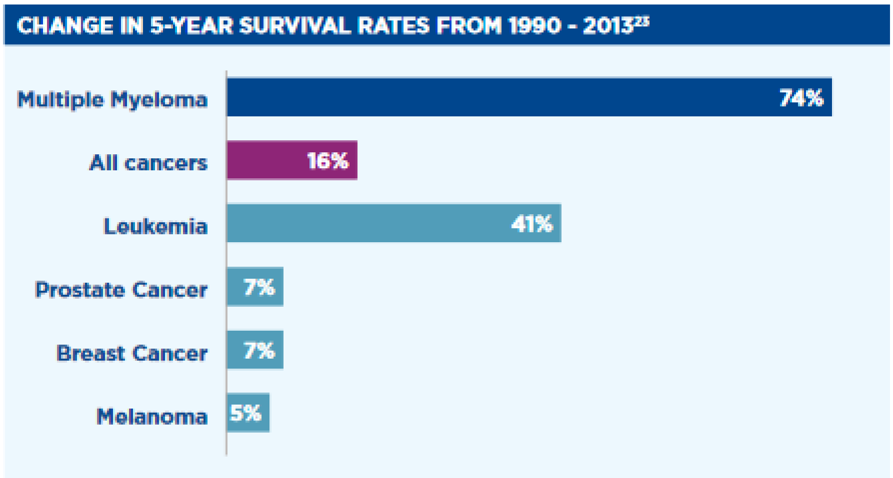



*Figure 4.1: Patients' improved outcomes after the company's treatment (source, the company's annual report, 2017)*

Currently utilising innovative platforms for data management and analytics capabilities, the company has made a transition to value-based, personalised healthcare. This transformation was enabled by focusing on the consistent and coherent integration of Big Data initiatives. The company's senior management team believed that a cloud-first platform strategy, with enterprise information management, served as the foundation for leveraging Big Data to improve understanding of disease and to develop targeted therapies and treatments (Annual report, 2017).

Using collaboration as a source of innovation, the company was making investments not only to harness the data that is generated across the enterprise, but also the real-world healthcare data generated by its expanding network of partners. However, throughout these processes, the company experienced numerous challenges and changes, beginning in 2013 and continuing to the present day. The company's commitment to and involvement in an innovative approach for Big Data management, particularly in the Information Knowledge Utilization (IKU) projects (at the Global and EMEA sites) for Big Data initiatives, offered an excellent empirical grounds for this research to inquire into the company's Big Data capabilities development processes.

As discussed in the literature review (Chapter 2), although the development of a capability may be enhanced or developed by the diversity of a firm's experience, this process is challenging, and depends on many internal and external factors. Taking a single case-study approach allowed the researcher to conduct an in-depth examination of a particular case about capabilities development in the Big Data implementation process within the company. A comprehensive investigation of how the company learned more about the resource of Big Data itself, and how to build capabilities related to its use, helped the researcher to shed more light on what is still unknown and has not yet been explored. Ultimately, this was an important path to the generation of knowledge about Big Data and the development of required capabilities.

### *4.3.2 Research Quality*

Although the case-study approach was seen to be the most suitable choice for this study, it was important to consider and address certain issues associated with research quality throughout the process. In particular, the choice of a case study meant that the attributes most strongly associated with it, as discussed by Yin (2003), Eisenhardt (1989), Walsham (1993), Creswell (2012) and Miles and Huberman (1994) such as its *generalisability, validity, reliability*, and its *units of analysis*, needed to be accounted for in order to ensure the quality of this research.

**Generalizability**- In essence, generalizability is a measure of how well the conclusions of research can be applied to the population as a whole.

Although critics of the qualitative case-study approach claim that findings derived from case studies cannot be generalised on the grounds that individual cases are not representative, and that there is an insufficient sample size from which to draw statistically meaningful results, Walsham (1993) points out, that generalizability from case studies is possible. It is possible because the validity of an individual case or cases '*depends not on the representativeness of such cases in a statistical sense, but on the plausibility and strength of the logical reasoning used in describing the results from the cases, and in drawing conclusions from them*' (Walsham, 1993, p. 15). Similarly, Stake (1980) stated that a process of natural rather than statistical generalization results from recognising the similarities of the objects and issues in different contexts and by understanding changes and differences as they present themselves (Stake 1980 in Sturman 1997, p. 69). However, for this kind of generalization to be possible, it is essential to ensure that both the *silent and salient* features of the case are documented, so that new situations can be enhanced by a very thorough understanding of a known case (Sturman 1997, p. 63). Holding a similar position, Easton (2010) pointed out that the strongest grounds for generalizability in qualitative case study research begin with rigorous attention to the study's design and methods for gathering and analysing information-rich data (Yin 2003); its attention to validity, reliability, and triangulation (Patton, 2002); a well-developed theory emerging from the findings, and in establishing a trail of evidence from data collected to the theory that is developed (Eisenhardt,1989).

In addition, generalizability has particular significance in the CR and requires further elaboration relative to case study research. Generalizability in a CR setting provides a means to leverage existing statements of causal mechanisms to explain events observed within the specific context of the new setting as opposed to predicting outcomes based on the generalization of theory to a new population or context (Wynn and Williams, 2012). This serves to validate the explications of causal tendencies and the interplay of mechanisms and context and helps to refine our theories. For example, given the highly-complex nature of Big Data and the required capabilities development phenomenon it would be impossible to expect identical or even highly similar outcomes if a given study were to be replicated in a different organisational, industrial, regional, or cultural setting (Wynn and Williams, 2012). Rather, the intent of this research, conducted under the CR settings as explained in the previous section, was to generate detailed causal explanations of the phenomenon in a given setting to obtain insights as to how and why a similar mechanism could lead to different, or perhaps similar, outcomes in a different setting (Becker, 1990). Hence the generalization within CR-based case-study research is more *generalization to theory* (Lee and Baskerville 2003; Yin 2003) rather than a measure of how well the conclusions of research can be applied to the population as a whole. Thus, theoretical validity is crucial (Maxwell,1992). Any theory has two components: the concepts of categories that the theory employs, and the relationships that are thought to exist among these categories. Corresponding to this are two aspects of theoretical validity (the 'fit' of data, and theoretical explanation) that according to Maxwell (1992) are crucial for generalizability.

The selection of a case study organisation for this research was followed by theoretical sampling techniques rather than statistical sampling due to nature of the research. Theoretical sampling attempts to discover categories and their elements in order to detect and explain interrelationships between them (Eisenhardt, 1989). *A priori* specification of a theoretical concepts is valuable because it permits researchers to measure constructs more accurately. If these constructs prove important as the study progresses, then researchers have a solid empirical grounding for the emergent theory. A theoretically-based and empirically-validated model (Figure 5.4) of this research, which establishes a credible trail of evidence between the data collected and theoretical propositions, ensures the plausibility and cogency of the results derived by this case study's research design and, hence, overcomes the criticisms in terms of generalization from the case study approach. The initial conceptual model of this study served as a guide for the data collection and analysis phases. The emergent model is proposed as a guide to organisations embarking on a Big Data initiative.

In addition, Eisenhardt (1989) highlights the importance of comparison of the emergent concepts, theory, or hypotheses with the extant literature. This involves asking *what is this similar to,* and *what does it contradict*, *and why*. Literature discussing similar findings is crucial as is strengthens the confidence that the findings are valid and generalizable because others had similar findings in a very different context (Eisenhardt,1989; Leonard-Barton, 1990). Thus, this linkage with a variety of literature in other contexts raises the reader's confidence, as well as allowing the conceptual level of findings to be elevated to the more fundamental level of punctuality and strengthen their likely generalizability to other project teams.

The findings and contributions (see Chapter 5 and 6) of this study are discussed in line with both the empirical and the theoretical literature, ensuring the validity of the findings and the contribution to knowledge and strengthening the generalizability of this case-study research.

**Validity** is a measure of how well the results can be justified and considered to be a true and accurate reflection of reality (Yin, 2003). To overcome subjective judgement issues the research used multiple sources of data (data sources will be discussed in detail later in this chapter) in order to improve overall validity. In addition, a number of tactics were used during the data analysis and presentation stages in order to increase internal validity. For example, to minimise interpretation bias, the collected data is presented whenever possible in the respondents' exact words, with direct quotations of interviewees being used to justify the resulting interpretations. Furthermore, for the critical realist, internal validity is concerned with establishing a chain of evidence that the generative mechanism is a possible cause of the events occurring in the study. Having two units of analysis - the company's Big Data adoption and capabilities development projects for each site of the company (Global and EAMA) - allowed the researcher to decompose the data into periods, consisting of different phases (planning, building, operational) thus enabling the explicit explanation of how action in one phase and/or project led to action and changes in Big Data adoption and the capabilities development processes in another phase and/or project within the case study company. Furthermore, to increase construct validity and the reliability of the information, every step of the research study was documented, and these documents are attached as an Appendixes to the final work.

**Reliability** is a measure of the extent to which a set of results can be regarded as being dependable (Yin, 2003). In order to increase reliability the case study protocol and interview guide were used, and a database of collected data was developed. The case study documents were stored in the cases database, and all interviews were recorded, transcribed, and documented.

Table 4.2 below presents a summary of the different tactics, including their explanations and the recommended case study actions (Yin, 2003; Creswell, 2012), and the measures that were undertaken at different stages of this research to maintain the quality of the case study.

| Test | Explanation | Case study tactic | Phase of the research |
|---|---|---|---|
| **Generalizability** | A measure of how well the conclusions of research can be applied to the population as a whole. | The selection of a case study organisation for this research was followed by theoretical sampling techniques rather than statistical sampling due to nature of the research.<br><br>A theoretically-based and empirically-validated model (Figure 5.4) of this research, which establishes a credible trail of evidence between the data collected and theoretical propositions, ensures the plausibility and cogency of the results derived by this case study's research design and, hence, overcomes the criticisms in terms of generalization from the case study approach.<br>The findings and contributions (see Chapter 5 and 6) of this study are discussed in line with both | **Data Collection, Data Analysis, Discussions and contributions** |

| | | | |
|---|---|---|---|
| | | the empirical and the theoretical literature, ensuring the validity of the findings and the contribution to knowledge and strengthening the generalizability of this case-study research. | |
| **Validity** | A measure of how well the results can be justified and considered to be a true and accurate reflection of reality (Yin, 2003). | To minimise interpretation bias, the collected data is presented when possible based on exactly what the respondents said. Furthermore, direct quotations of interviewees are used.<br><br>To avoid conclusion bias, the interview results were checked by supervisors. | **Data analysis** |
| **External Validity** | A measure of how well the conclusions of the research can be applied to the population as a whole | Empirical data was compared with theoretical findings. | **Data analysis** |
| **Reliability** | Demonstrate that the operations of a case study can be repeated with similar results | Research procedures were documented. Some materials are attached as an appendixes.<br><br>An interview guide was prepared.<br><br>All interviews were recorded, transcribed, and documented.<br><br>Collected data were documented and archived.<br><br>To avoid influencing interviewees, open-ended questions facilitated an appropriate condition to obtain the respondents' own words and opinions.<br><br>To avoid incorrect interpretation and likely bias, the author's interpretation was checked by supervisors. | **Data collection**<br>**Data collection**<br><br>**Data analysis and writing up stage.** |

*Table 4.2: The Quality Measure of the Case Study. (developed by the researcher based on source Yin, 2003)*

## 4.4 The Units of Analysis

As mentioned above, one of the important aspects of ensuring the quality of the case study design is the unit of analysis, defined as the area of focus for the study (Yin 2003). Informed by the research strategy described in the previous sections, the framework for collection of data was an in-depth case study of a global pharmaceutical company. Accordingly, the units of analysis were the company's Big Data adoption and capabilities development projects for each site of the company (Global; EAMA). Presenting the timeline and stages that were involved in the adoption of Big Data initiatives, and in the process of development of required capabilities, the next sections (4.4.1 and 4.4.2) highlight similarities and differences between the projects in different phases (planning, building and operational). It must be noted that during the interviews, the planning and building phases in both sites of the company had already been conducted, while the operational phase was in progress for both sites.

### *4.4.1 The Company's IKU Project at the Global (US)*

The Big Data initiatives adoption project at the company was recognised as a journey that the company was embarking on to transform how the company would and utilize Big Data and develop required capabilities for its effective use. The Big Data initiatives planning at the company's global headquarters initially started around 2015 with the question of what Big Data means for the healthcare industry and for the company, which gradually progressed into a strategic initiative in mid-2016 when the company started identifying more precise questions, such as where the company stood in the ongoing Big Data revolution environment, and what strategy was going to be used to implement Big Data initiatives, and where the company has to be and how they would get there. When the company arrived at a more defined Big Data initiative strategy it assembled a small team called the IKU champions, supported by a strong partnership with Coverage HEALTH (a unit of Deloitte). The team designed a Big Data program called IKU (the Global project) which included the development of an overall strategy, as well as plans to invest and develop platforms and external partnerships, and to develop new capabilities for Big Data, data governance, and harmonisation (planning phase).

The project was shaped around five work streams, as presented in figure 4.2 below.

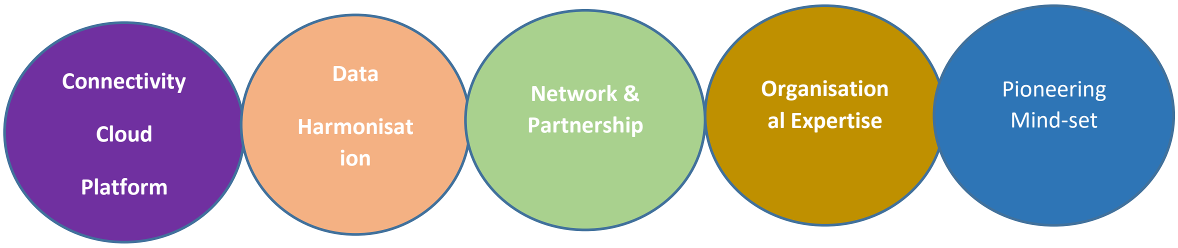



*Figure 4.2: The Five Essential IKU Work Streams (ID04)*

The objective of the project was to shift to more value-based healthcare. This would be achieved in partnership with organisations that are experts in data and technology that would complement the company's ability to develop the capabilities to use electronic healthcare data that was generated many years ago.

Figure 4.3 below shows the stages of the IKU (Global) project and a timeline of the

| **2015 Searching and Discovery Stage. (Sense and size)** | **2016 A Could Base Platform Implementation Stage** | **2017 January IKU Kick off Synapse Could Base Platform Start UP Stage** | **2017 Jan to May Data Harmonization and Data governance** | **2017 Partnership IBM Watson, GNS Healthcare** | **2017 October Start using Big Data in research areas. New app Suite** |
|---|---|---|---|---|---|
| Strategic initiatives: What does big data mean for the company? What is IKU going to be? Where we need to be? How we are going to be there ? | Analytic environment. Service catalogue. Question about existing data. Introductory debates and discussions on big data opportunities. | Self-serve analytical application. Explorer. First Draft and Champions. | Engagement with the experts to build technical and data science capabilities. Skill set. Data science alliance management. | Partnerships with organizations that are experts in data and technology to compliment company's Big Data management ability | |

*Figure 4.3: Stages of IKU Project and Timeline of Implementation Processes at the Global site of the Company. (Based on researcher's synthesis of multiple data sources)*

### *4.4.2 IKU Project at the Company's EMEA Site*

The company's EMEA IKU project also follows five essential work streams, as identified by a Global team. However, the IKU project at the EMEA site started in January 2017 when the *Synapse* platform went live. Therefore, planning and building phases were slightly different. Figure 4.4 below illustrates the stages of EMEA's IKU project and highlights the timeline of the implementation process.

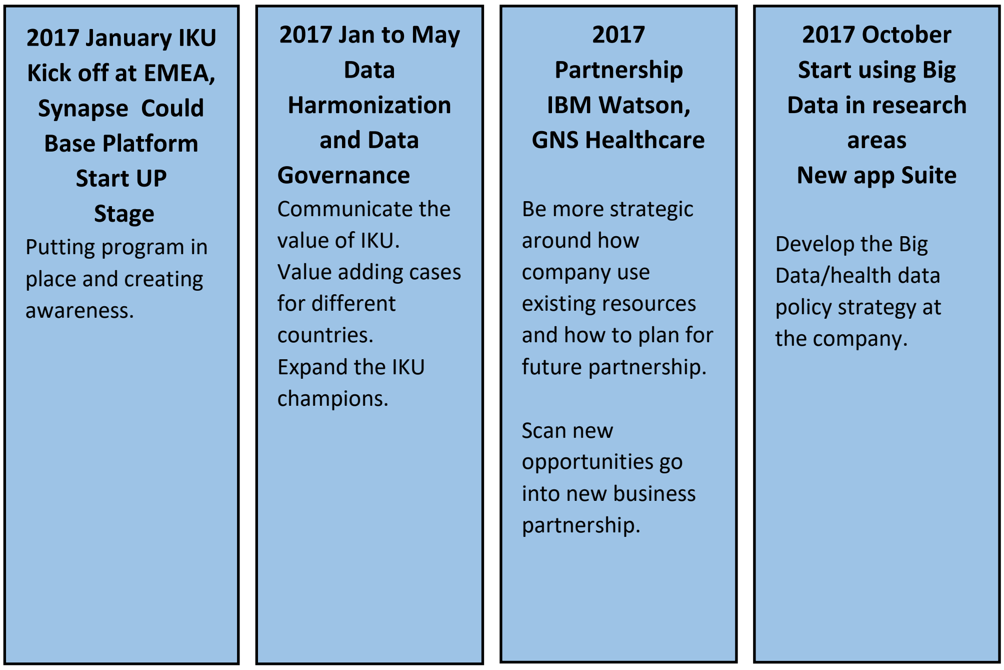



*Figure 4.4: Stages of IKU project and Timeline of Implementation Processes at the EMEA site of the Company. (Based on researcher's synthesis of divers data sources)*

The main goal of the EMEA project was to put in place a program that started at the global site of the company, as well as create awareness of the IKU/Big Data project within the company. The project members (IKU champions) were senior members from the company's EMEA headquarters and the company's different European franchises (Affiliates). The first step at the EMEA project was to increase awareness of the project and about Big Data thinking within the company. After building the technological platform to address connectivity challenges, the IKU champions started going to different departments to identify projects where Big Data could help, and developing capabilities to communicate these insights across the company to increase cross-functional coordination. The aim was to support the interaction of data sets across the company by breaking the silo mentality that separated internal functions, and enhancing collaboration and coordination. A great deal of attention was paid to the discovery of new opportunities, checking that the science was sound, and then entering business partnerships with academics and small companies who were experts in Big Data.

#### *4.4.3 The Choice of Empirical Sample*

This research assumed that professional opinions regarding Big Data as a strategic new resource, and the capabilities needed to meet the challenge of the new digital environment, were crucial to answer the research questions. Danneels (2010) argues that managerial views of an organisation's resources and capabilities are essential to explaining how organisations manage resources to create value. Therefore, this study used a '*judgement sampling'* technique when selecting the appropriate research participants, which is a type of sampling technique where the researcher selects participants based on their knowledge and professional experience. The participants in this research were selected based on their perceived experiences of a Big Data environment, along with their ability to provide rich insights about the Big Data initiatives project. Moreover, these participants consisted of several levels of managers from both sites of the company, including project team leaders, as well as external partner members. All participants had direct day-to-day decision-making responsibilities for the projects and were immersed in the Big Data capabilities development processes.

#### *4.4.4 Negotiation of Access.*

Access to the case study company at the initial stage was negotiated between the researcher and the company's Vice President (VP) who was also directing the IKU/Big Data project. After some information exchange about the research context (Appendix 1) (via emails) and a face-to-face meeting in Switzerland at the company's EMEA headquarters, access was initially approved. After the meeting in Switzerland negotiations progressed to the next stage, resulting in completing the agreement. This was followed by signing the Confidential Disclosure Agreement (CDA) with the Company (Appendix 2); the researcher was then given a list of recommended employees, along with their contact details, who were held to be suitable participants for the research.

An introductory email, along with a brief summary of the research (see Appendix 3) and an information sheet outlining key practical and ethical considerations with a consent section attached (see Appendix 4 and Appendix 5) were sent directly to the recommended participants by email. The interviews were arranged directly with the participants to suit their availability.

## 4. 5 Data Collection

### *4.5.1 Method of Investigation*

To achieve valuable insight, this research used multiple sources of evidence and triangulation techniques to establish the validity of the findings. Triangulation is often defined as '*a combination of methods used to study the interrelated phenomena from multiple and different angles or perspectives*' (Yin, 2009, p.18). The research collected primary data from the 24 semi-structured interviews. The company's documentations and meeting observations were used as additional data sources.

Having access to the working environments of both the company's EMEA and Global headquarters, and being able to observe how project members were immersed in their daily routines, offered the researcher the opportunity to observe and understand the participants' lived experiences. Talking to project members and attending meetings (discussions regarding Big Data initiatives and project progress) helped the researcher to investigate and explore those processes which persuaded the company to start Big Data initiatives. Furthermore, having access to multiple sources of information was helpful to provide an in-depth picture of the ways in which the company achieved progress with its Big Data initiatives development.

### *4.5.2 Primary Data*

Primary data was obtained from 24 semi-structured interviews. Interviews were conducted during face-to-face meetings with managers from both the company's EMEA and Global sites, all of whom were personally involved in a Big Data utilisation (IKU) project and had an accurate assessment of the context. Skype and WebEx interviews were used to reach the company's leaders from several different European countries (Italy, the Netherlands, Germany, and France). Interviews were conducted with managers at several levels from both the EMEA and Global sites of the company, including 3 Vice Presidents (VPs), 3 executives, 15 senior directors, general managers, and project team leaders, as well as 2 external partners who were helping the team develop capabilities for Big Data. Interviews typically lasted 40-60 minutes. All interviewees had direct day-to-day decision-making responsibilities for the project. As the project is ongoing, the interviews were conducted during the capabilities development period when the events were still recent and active topics in the interviewees' minds.

The interviews were semi-structured and open-ended. Senior managers were asked about the processes of developing capabilities and the challenges of implementing Big Data initiatives (see Appendix 6). Questions were also posed about the company's existing resources and capabilities, such as: people, processes, and technology. Particular attention was given to the technology they have built and were building as part of the IKU project to drive business value and develop Big Data required capabilities. It should be noted that all interviewees were professionals with long-term experience of working within the pharmaceutical industry on different Big Data-related projects both within and outside the company. Therefore, they were a most suitable sample for this study.

Table 4.3 below provides an overview of the primary data of this study.

| Interview Code | Order | Title of Informant | Specific Unit | Company’s Business Unit | Interview type |
|---|---|---|---|---|---|
| IG01 | 1 | Exclusive Director | Information Knowledge Utilization (IKU) | Global (Summit. NJ) | Face-to-face interview |
| IG02 | 2 | Vice President, Global | Planning & Technology Operations | Global (Summit. NJ) | Face-to-face interview |
| IG03 | 3 | Director Alliance manager | Information Knowledge Utilization (IKU) | Global (Summit. NJ) | Face-to-face interview |
| IG04 | 4 | Director, Knowledge Utilization | Information Knowledge Utilization (IKU) | Global (Summit. NJ) | Face-to-face interview |
| IG05 | 5 | Vice President | Information Knowledge Utilization (IKU) | Global (Summit. NJ) | Face-to-face interview |
| IG06 | 6 | Senior Director, IT Enterprise Architecture | IT GOS Administration | Global (Summit. NJ) | Face-to-face interview |
| IG07 | 7 | External partner in data management technology | Deloitte | Global (Summit. NJ) | Face-to-face interview |
| IG08 | 8 | Executive Director. Data management | Information Knowledge Utilization (IKU | Global (Summit. NJ) | WebEx Conference Interview |

| Interview Code | Order | Title of Informant | Specific Unit | Company's Business Unit | Interview type |
|---|---|---|---|---|---|
| IE01 | 9 | Senior Director | Information Knowledge Utilization (IKU) | EMEA (France) | WebEx Conference Interview |
| IE02 | 10 | Associate Director, IT | IT EA and Information Management | EMEA (Switzerland) | Face-to-face interview |
| IE03 | 11 | Senior Director, Data Science Director | Information Knowledge Utilization (IKU | EMEA (Switzerland) | Face-to-face interview |
| IE04 | 12 | Associate Director, Market Insight | Market Research and Competitive Intelligence. | EMEA (Switzerland) | WebEx Conference Interview |
| IE05 | 13 | Director, Knowledge Utilization | Information Knowledge Utilization (IKU) | EMEA (Switzerland) | Face-to-face interview |
| IE06 | 14 | Vice President GM Italy | Information Knowledge Utilization (IKU) | EMEA (Italy) | Skype for Business Interviews |
| IE07 | 15 | Global Medical Director | Medical Research | EMEA (Switzerland) | Face-to-face interview |
| IE08 | 16 | Global Clinical Director | Clinical Research | EMEA (Switzerland) | Face-to-face interview |
| IE09 | 17 | Director, Statistician | Principal Biostatistician | EMEA (Switzerland, Prague) | Skype for Business Interviews |
| IE10 | 18 | Corporate Affairs Communication, Government Relations. | Information Knowledge Utilization (IKU) | EMEA (Switzerland) | WebEx Conference Interview |
| IE11 | 19 | Vice President, Global Planning & Tech Operations | Information Knowledge Utilization (IKU) | EMEA (Germany) | WebEx Conference Interview |
| IE12 | 20 | Senior Director, IT Enterprise Architecture | IT & Communication | EMEA (Switzerland) | Skype for Business Interviews |
| IE13 | 21 | General Manager, Converge Health | Information Knowledge Utilization (IKU) | EMEA (Switzerland) | Skype for Business Interviews |

| Interview Code | Order | Title of Informant | Specific Unit | Company's Business Unit | Interview type |
|---|---|---|---|---|---|
| IE14 | 22 | Executive Director, Media Affairs & Communications | Netherlands Medical Affairs | EMEA (Switzerland) | WebEx Conference Interview |
| IE15 | 23 | Vice President, Global Planning & Tech Ops | Information Knowledge Utilization (IKU) | EMEA (Switzerland) | WebEx Conference Interview |
| IE16 | 24 | External partner in data management technology | Deloitte | EMEA (Switzerland) | WebEx Conference Interview |

*Table 4.3: An Overview of the Primary Data of this Study*

### 4.5.3 Observations

Attending the project's formal meetings at the EMEA site (two meetings) and the corporation-level meeting at the Global site between July and October 2017 allowed the researcher to obtain a first-hand observation of the project members' activities within the context of the development of Big Data initiatives. The presence of the researcher during the meetings also permitted the understanding of different activities and processes, such as how communication between the Global site and its affiliates was conducted, and how the tasks for the next meeting were identified and aligned in a real-time context. Being immersed in these activities also assisted with the visualisation of senior management involvement and interaction during these processes, and enabled the researcher to observe '*heightened awareness about social processes*' (Saunders et al., 2012, p. 299) which was reflected during the data analysis and writing up stage of this research.

### 4.5.4 Secondary Data: Documentary Evidence

The annual reports of the company, along with those documents that were given to the researcher about the project, constituted the major source of documentary evidence for this research. In addition, other documentary data such as information from the company's websites and the company's senior members' (CEO; Executive Director Government Affairs and Global Health Access) publicly available interviews further added to the evidence used in this study.

Table 4.4: demonstrates the secondary data that was obtained for this study

| Data Code | Order | Title of Information | Specific Unit/ Title | Years of published materials |
|---|---|---|---|---|
| D001 | 1 | Published Interviews | CEO | 2016 |
| D002 | 2 | Project strategy | Vice President IKU | 2016 |
| D003 | 3 | Published Interviews | Executive Director Government Affairs and Global health access | 2015 |
| D004 | 4 | IKU project presentation | Information Knowledge Utilization (IKU) | 2016 |
| D005 | 5 | Annual Reports | The company | 2015-2017 |
| MN01 | 6 | Managers Meeting Note | EMEA (Switzerland) | 2017 |
| MN02 | 7 | Managers Meeting Note | EMEA (Switzerland) | 2017 |

*Table 4.4: The Secondary Data Sources of the Study*

## 4.6 Ethical Considerations

Ethical protocols were carefully considered and adhered to during all stages of the research. Due to the nature of this research, there was a possibility that the data gathered would include sensitive information of the kind which requires ethical consideration. Therefore, the study followed the ethical standards and the code of practice established by the Higher Education

Institution (HEI). Accordingly, the researcher was guided by the ethical principles outlined in the table 4.5 below, as suggested by Easterby-Smith et al. (2008), as a way of maintaining both professionalism and ethical conduct throughout this research.

| Step | Principles |
|---|---|
| 1 | Ensuring no harm comes to participants |
| 2 | Respecting the dignity of research participants |
| 3 | Ensuring a fully informed consent of research participants |
| 4 | Protecting the privacy of research subjects |
| 5 | Ensuring the confidentiality of research data |
| 6 | Protecting the anonymity of individuals or organisations |
| 7 | Avoiding deception about the nature or aims of the research |
| 8 | Declaration of affiliations, funding sources and conflicts of interest |
| 9 | Honesty and transparency in communicating about the research |
| 10 | Avoidance of any misleading, or false reporting of research findings |

*Table 4.5: Key Principles in Research Ethics*

In addition to the ethical guidelines in the table above, the researcher formally sought ethical approval of this research from the Open University's Human Research Ethics Committee (HREC) (see Appendix 6).

## 4.7 Overall Research Design

Table 4.6 below summarises the overall research design for this study, while the part of the chapter that follows discusses the methods of data analysis used in this study.

| | |
|---|---|
| **Main Research Questions** | **RQ1:** Why did the MNC in the pharmaceutical industry prepare for big data adoption?<br>**RQ2:** How the company approach the issue of using big data strategically and how they identified and develop their capabilities for big data?<br>I. What new capabilities do they develop?<br>II. How do they develop these new capabilities? |
| **Research Method** | Qualitative Case Study. |
| **Data Collection Methods** | **Primary data sources:** Semi-structured interviews<br><br>**Secondary data sources:** Observation, annual reports, documentation of case study organisations, |
| **Unit of Analysis** | Big data adoption and capabilities process in case study Company's both (Global and EMEA) projects. |
| **Sample** | **A "judgement sampling" technique.** Interviews were conducted with 24 managers at several levels from both EAMA and Global site of the company including 3 Vice Presidents (VP) 4 executives, 15 senior directors, general managers and project team leaders as well as two external partners that were helping the team to develop capabilities for big data |

| | |
|---|---|
| **Technique for Data Analysis** | The Thematic Analysis |

*Table 4.6: Summary of the Research Design for this Research*

# Chapter 4 Section 2 Data Analysis

## 4.8 Methods of Analysing Data

The data analysis process is one of the central parts of every qualitative research study. However, as an analytical method, qualitative data analysis is still undergoing challenges, and there is no single predominant approach (Strauss and Corbin, 1998; Easterby-Smith, 2008; Charmaz, 2006). Therefore, there is no single right or wrong way to analyse qualitative data. This study is thus informed by broader literature on the principles of qualitative data analysis (Strauss and Corbin 1998; Willigs, 2001; Broun and Clarke, 2006; Yin, 2009; Gioia et al., 2013). The study, however, mainly draws on the main principles of thematic analysis '*a 6-phase guide to doing thematic analysis*' explained by Broun and Clarke (2006), coupled with the general principles of case study data analysis proposed by Yin (2009) and coding structure (organising themes by categories) closely linked to the approach of Gioia et al. (2013).

During the analysis stage, the key aim was to identify and present an approach that would be consistent with the methodological (case study) and philosophical (critical realism) choices embedded in the broader research design (qualitative) of the study (Easterby-Smith et al., 2008, p.172). The structure for the data analysis was anticipated to reflect the conceptual framework of this study and research questions (see Chapter 3). Yin (2009) notes that one important practice during the analysis phase of any case study is the return to the propositions/concepts of the study, as:

- ✓ It leads to focused analysis and allows one to stay within the scope of the research questions
- ✓ It supports the exploration of concepts when attempting to provide an alternative explanation of a phenomenon
- ✓ It leads to increased confidence in the findings

As with any other, the conceptual framework of this study carried with it a number of assumptions about the nature of the data, what it represent in terms of '*reality*' (Broun and Clarke, 2006), and this allowed the researcher to start the analysing process with a '*start list'* of pre-set codes. However, a number of codes also emerged from reading and further analysing the data. Through the theoretical freedom of thematic analysis, which acknowledges the ways individuals make meaning of their experience and, in turn, the ways the broader social context impinges on those meanings (Willig, 2001) it was possible to consider those emergent codes and to sensitise the researcher to the idea of letting '*data speak for itself'* (Easterby-Smith et al., 2008, p. 173).

The aim of this study is to identify common, as well as conflicting, truths in the experiences of a number of individuals involved in a Big Data utilisation project who experience the capabilities development process within a global pharmaceutical company. Although thematic analysis has been criticised for not identifying with any epistemological position, Braun and Clarke (2006) suggest that this represents a strength, in that it can be applied more flexibly to determine a rich and detailed account of data. Therefore, thematic analysis was considered an appropriate methodology for this study, to analyse and synthesise analysis of a large amount of data from multiple participants into a meaningful account.

Figure 4.5 illustrates the systematic approach adopted in this study for developing codes and themes from the interview data and then subsequently aggregating them for theoretical discussion (Appendix 7). Following the working analytical framework (coding structure) helped to achieve clarity around the analysing process, to guide new insight, and arrive at a visual diagram for the data analysis and structure.

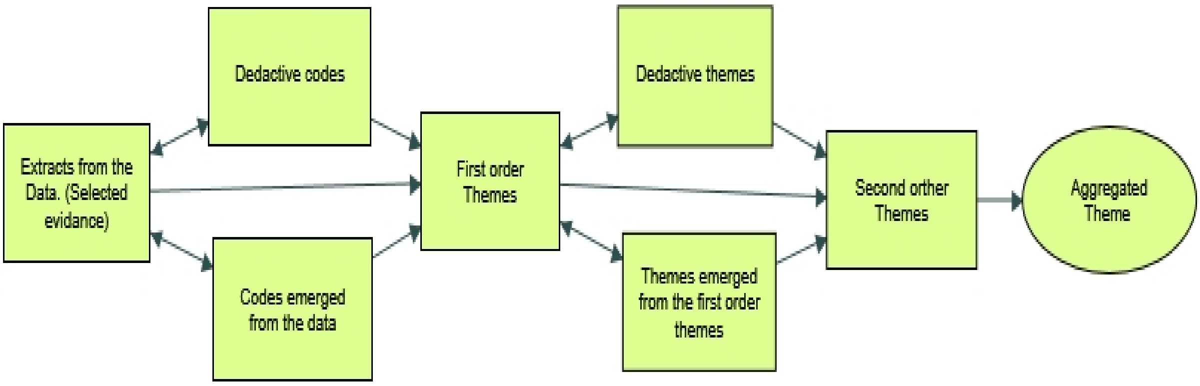



*Figure 4.4: The Working Analytical Framework (coding structure) (Based on researcher's synthesis of diverse sources of literature on data analysis techniques: Broun and Clark, 2006; Yin, 2009; Gioia et al., 2013)*

### *4.8.1 Data Analysis Process for this Study*

The data analysis process for this study was supported using the *NVivo 11* software package. As Braun and Clarke (2009) note, (supported by the researcher's previous experience) this tool is useful in operationalising the chosen methodology's transparency, validity, and reliability. This tool was particularly useful when capturing the initial research design, and when integrating and interrogating all project materials (data) in one place (Silver and Lewins, 2014). The software package was available in the university system, and training for using the software was undertaken by the researcher. As was mentioned above, the process of data analysis was guided by Braun and Clarke's (2006) six guidelines for phases of analysis, as follows:

**Familiarisation with data** - Given the time limit within which to complete the project, instead of waiting for the fieldwork to be over the researcher started to transcribe interview data in parallel with fieldwork activities. Transcribing data immediately after each interview (when it was possible) gave the researcher the opportunity to become immersed in the data and to improve the quality of the subsequent interviews.

The '*Listen N Write*' software for transcribing audio recordings helped ensure transcription quality. However, as the process of transcription proved time-consuming even with this support, half of the interviews were transcribed by the *Way With Words* professional service company. Once all of the data had been transcribed, for accuracy all the transcripts were checked against the original audio recordings and the interview transcripts made anonymous before there were installed into the *Nvivo 11* 'Big data capabilities KG' project.

The transcripts were read over several of times in the interests of becoming familiar with the data, and initial ideas were noted down and saved as memos. While reading the transcriptions the researcher was aiming to identify extracts at the semantic, or explicit, level (Braun and Clarke, 2006), as opposed to a latent level that requires more interpretation of meanings. However, the semantic nature of the data analysis meant that the researcher was not aiming to interpret the participant's experiences, merely to group them thematically according to their semantic meaning, based on prior identified concepts (e.g. Digital environment, Big Data as a new resource; Other resources; Existing capabilities (Marketing, IT); DC). Different analytical notes (memos) were developed based on each interview within each unit of analysis (Global, EMEA). Generated memos were grouped under relevant themes for every concept. Once all transcriptions had been read and organised, a data analysis plan was created for each research question to guide the analysis process.

**Generating initial codes** - This phase involved organising the data into meaningful groups. Using *NVivo 11*, codes/nodes were identified manually or by using text search queries. Transcripts were read line-by-line, and extracts or 'chunks' of meaningful text were highlighted. The aim of this step was to build up a list of relevant topics that arose from the interviews and that was initially considered important to the subject under investigation. Informants' terms, phrases, or meanings that were common between the interviewees were grouped (Appendix 8) with the aim being to answer the research inquiries such as:

- How does the company engage in Big Data initiatives activity?

and

- How does this in turn influence Big Data capabilities development?

In order to achieve further insight, coding data were explored between data and preliminarily identified concepts (from the conceptual framework and from the literature), like deductive codes, and other interesting occurrences relevant to the research queries and codes that emerged from the data. Having completed the initial coding of all transcripts, the component elements of each code were considered for consistency or overlap with other codes. This provided the opportunity to begin defining the codes, and to link these together into groups. Some initial codes were abandoned or merged at this stage due to overlap with others. The resultant codes were then compared against the research questions in order to ensure that only the codes that significantly contributed towards the research were pursued.

By this point, a total of 30 deductive codes/nodes had been established, and a further 23 codes/nodes had emerged from the data, which were kept in separated folders (see Appendix 10 for of *Nvivo 11* codes).

**Searching for Themes** - After the initial coding, the next phase involved sorting the different codes into potential themes. Careful consideration was given to identifying the relationship between codes and sub-themes that were developed from the coding groups, linking the data together, and also meaningfully linking back to the research questions. Using the *Nvivo 11* mind-map (Appendix, 11), themes were re-arranged according to the semantic content of the codes, and then a deeper exploration of their meaning was explored. A semantic approach is consistent with the critical realism epistemological position in that it limits over-use of subjective interpretation and focuses on identifying common semantic themes within and between the transcripts. This study focussed on providing a description of the patterns in semantic information in the dataset, and then summarising, interpreting, and theorising around the broader meaning and implications of the patterns found.

As Braun and Clarke suggested, deciding on themes is a question of prevalence, '*in terms both of space within each data item and of prevalence across the entire data set*' (2006, p. 82). However, although there is a need for there to be a number of extracts for a theme across the data set, a higher prevalence does not necessarily make the theme more important to the research. As there is no set rule for the proportion of data or number of themes, frequency for this research was considered as the number of participants commenting on a specific issue, rather than the frequency of codes related to it. This again involved discarding themes due to insufficient data, or merging two themes into one. Initially, the themes were influenced by the concepts from the study's conceptual framework, literature, and research questions.

However, it must be acknowledged that the top-down and the bottom-up processes of identifying themes were interactive in some way, because even though the researcher was specifically interested in identifying themes, after reviewing the themes and their subcategories other important themes emerged from the interview data, such as: e.g. Increase awareness and building trust; Shaping organisational culture; Networking and partnership. This was achieved as a result of discovering in the data certain repeating patterns which related to research queries but which were not fully covered in the conceptual framework. It became apparent that some terms were repeatedly brought up during discussions. Instances of newly-emerged themes such as: Developing shared Big Data vision; Shaping the organisational culture, and; Networking and partnership were themselves broken down into categories to capture the richness of the phenomenon.

**Defining and Naming Themes** - At this point the researcher identified the essence of each theme and determined which aspect of the data each of them represented. Themes were continually reviewed until they were judged to be consistent across all participants and, at the individual level, supported by quotes and named appropriately. The identified themes are intended to provide a rich and detailed description of the overall case. Chapter 5 provides detailed information about the final themes and the analysis of research data within them.

**Producing the report** - This phase involved writing up the report about research data to convince the reader about the validity of the analysis. Braun and Clarke's (2006) suggest that the report should provide sufficient evidence (data extracts) of the themes within the data to demonstrate prevalence of the theme. All the themes reported in the data findings in Chapter 5 are supported with valid examples or extracts which capture the essence of the point that the theme represents. On the other hand, Baxter and Jack (2008) state that due to its complexity, reporting a case study is a difficult task and it is the researcher's responsibility to choose a comprehensive format to deliver a reflexive report to ensure transparency of the analysis process. Some suggested ways to deliver a quality report are:

- ✓ Tell the readers a story, by delivering a chronological report about the case
- ✓ Write a rich description of the case (who were the actors, what was their interaction, perceptions etc.)
- ✓ Deliver the report by addressing and describing themes within and across the case

The next Chapter (5) provides a synthesis of the above suggestions and presents a description of the data interpretation that informed the themes.

## 4.9 Chapter Summary

This chapter discussed the research design and methodology that was followed to investigate the research problem and to fulfil the objectives of this study as identified in Chapter 2 and Chapter 3. The first part of the chapter provided justification for the choice of overall qualitative case study research strategy, the unit of analysis, the choice of empirical sample and data collection, while the second part of the chapter outlined the methods used for data analysis.

The next Chapter (5) presents the findings based on a description of the data interpretation that informed the themes.

# Chapter 5: Findings

## 5.1 Introduction

This chapter presents the findings of empirical research that utilised interviewing and secondary data analysis methods within a case study company. The main focus of this study was to understand how the company prepared for the adoption of a new resource like Big Data. The case study approach was used to investigate the influential factors that persuaded the company to consider and to introduce Big Data initiatives.

The findings are presented in two parts, with one based on the findings made at the Global (US) site and the other based on the EMEA site of the company preparing for the adoption of a Big Data initiative. As the project was originally planned at the Global site, the US site was found to be more advanced in its Big Data adoption than the rest of the company.

Section 5.2 presents the analyses of the company's overall approach to preparing for the innovation, including discussions on the processes they introduced and carried out. This section also presents findings of the planning and building phase of the project that initially took place on the Global site and which was later rolled out to the EMEA site. The findings from the EMEA site are presented in section 5.3. A generic model based on the overall findings is also presented in this chapter. This model is then used to highlight major similarities and differences between the two sites in terms of building Big Data capabilities and other influential factors in the Big Data adoption process. Section 5.4 then evaluates these similarities and differences and summarises the findings chapter.

The findings for both sites are guided by the components of the Conceptual Framework (CF) that was developed based on the research questions of this study, with the same themes also informing the data analysis. For this reason, in order to demonstrate how the findings align with the main themes of the CF, the same numbering system is used when presenting them. For example, the Digital Environment is number 1 in the CF (see Figure 3.1) and the corresponding theme is presented as CF1.

The associated findings for the operational/existing and DC capabilities derived from the presented data are shown in tables (see tables 5.1, 5.2, 5.3, 5.4, 5.6 and 5.7 for the Global site and 5.7, 5.8, 5.9, 5.10, 5.12 and 5.13 for the EMEA site).

## 5.2 Global Site Findings

The findings in this section are based on a set of interviews (marked as (IG*XX*)) and the company's secondary data, such as annual reports, CEO reports and project planning documents. Quotations from the secondary data are marked as (DO*XX*). Overall, there were eight interviewees representing senior management and the leadership of the company's Global site. The Global site was the first to prepare, introduce, and adopt Big Data initiatives to the company, initially deployed at the US site then rolled out to the EMEA site.

### *5.2.1 Digital Environment (CF.1)*

The proliferation of smart devices and the sheer amounts of diverse types of data being gathered and explored in the entire healthcare ecosystem, and across the rest of the world, has resulted in the case study company exploring and developing Big Data initiatives. Indeed, the company - whose mission is to discover, develop, and commercialise innovative therapies for the treatment of cancer, immune-inflammatory, and other diseases - requires and is well-positioned to leverage the information generated by both existing digital platforms and new smart devices across the health care systems. The Global site team of the company had the overall management and leadership responsibility for the entire organisation and was the first to identify the opportunity represented by Big Data and advanced analytics to strengthen the company's core business. The project that was the focus of this study was the firm's very first attempt to introduce and adopt a large-scale Big Data initiative. An ever-advancing and challenging digital environment in which the company operates significantly influenced the company's decision to explore Big Data initiatives. As the CEO of the company commented:

> *We are living in an exciting era of scientific breakthroughs coupled with technology convergence. This creates both disruption and opportunity. The explosion and*

*availability of data, the cloud, analytics, mobility, artificial intelligence, cognitive computing, and other technologies are accelerating data collection and insight generation, opening new pathways for collaboration and innovation.* ***DO02***

The trends witnessed in the digital environment, such as digital health, digital patient records, and personalised medicine were recognised as advances in the company's operational environment, influencing new initiatives.

As the Director of Knowledge Utilisation for the project remarked:

> *Trends that were happening in the industry around new players and during the health care market, like Apple and Google and then this whole like proliferation of health data, either between electronic medical records, more access to claims data, on social media, etc. That is what our leadership recognised, and they said if we don't get our hands around this, other people are going to get smarter than us* ***IG02***

A fundamental requirement for developing a digital vision and associated strategy is to possess an understanding of the digital environment in which the company expects to be operating in a few years' time. The company's intention to understand and obtain access to the digital environment, particularly at the planning phase of formulating its Big Data strategy, was captured in respondents' views - for example, the Senior Director of Data Governance of the project, who stated that:

> *Big Data's the next thing to happen… When you look through history of the world, you know this right, data is the thing that's happening now in our world. So what role do we want to take, and the company I think wants to be at the forefront of this and understands the need to be successful. Are we going to be able to shift to technology and be technology-focused, as opposed to perhaps pharmaceutical-focused? Right?* ***IG04***

Furthermore, within the company there was a widely-held belief that the wealth of data that are available around patients would continue to grow. The integration of data from various data sources, including the Internet, social media, and the so-called Internet of Things is a very important aspect of data utilisation. However, the question was how that was going to be linked to successful outcomes for disease detection and prevention, and to regulatory or market access. To remain competitive in the digital market environment it is important to consider the consequences of the new digital world in advance. As the Vice-President of the project explained:

> *If you didn't think about it in advance, what do you as an industry need to do or be ready for? you're going to have a problem. Do we build the foundational elements within the company to be able to start operating in this new future world? And be able to start connecting and creating insights around our patients in a world where we have all these different data sources and the potential for all of these different analytic techniques to enable us to do that, more cost effectively than ever before.* ***IG05***

Talking about the future of the healthcare ecosystem, the Senior Director of Data Science IKU also opined that:

> *It will be a world where we need to, you know, be much more precise in the development of our medications, such that we can identify biomarkers, and we are very clear on the patient populations, that our compounds can help. So kind of that precision medicine world. We will clearly be operating in a world of value-based reimbursement and if we don't get our hands around this, other people are going to get smarter than us.* ***IG07***

New technologies and regulations are constantly emerging, supporting and shaping the digital transformation ahead. Ongoing economic pressures on the healthcare ecosystem, the FDA, and some of the regulatory authorities that started to promote and embrace Big Data initiatives also had an impact on the company's decision to plan for and develop Big Data capabilities. As the Senior Director, IT Enterprise Architect commented:

> *You cannot doubt that it is influenced by what's happening externally. Whether that is what our own competitors are doing or whether companies completely out of the industry. Or just thinking about you know, some of the things that FDA and some of the regulatory authorities are starting to say and embrace in this digital world that we are all living in.* ***IG03***

Management support for the competent implementation and utilisation of Big Data, as well as the external factors discussed above, have been identified as influential factors in the adoption and use of Big Data in the case study company, particularly at the preparation stage. However, it was also evidenced that without senior management support the project would not progress to the next stage.

In a world where much more personalised and customised information engagement is expected, the company's global leaders anticipated the need to leverage Big Data initiatives alongside competing internal priorities. This led to the recognition of the company's ability and willingness to exploit the new asset of Big Data in order to develop new strengths and capabilities. One of the respondents expressed this view:

> *To be a pre-eminent company in pharma, we needed to treat data as an asset. You know and that was the push from our executives, to find out what role the company wants to play in this evolution that's in front of us.* ***IG04***

There was a common understanding between the participants that the most attractive and innovative opportunities would not be utilised easily. The process of implementing Big Data initiatives is incremental and develops gradually. However, the strategic choice was made, as a result of the number of synergies and opportunities that were identified, to create more enterprise-wide solutions (D001). The aim was to transform the company into a more data-driven, personalised, and digitalised enterprise, that would lead to value-based healthcare. As the CEO of the company established:

> *The company should first focus on providing technologies and platforms that support seamless information sharing. In the process, the company should constantly be looking at information flows through an enterprise lens—real value is created when information is connected across all functions. Last, there is need to recognise that every job description will include data and information skills. This is an especially exciting time to be in IT because the digital capabilities we provide increasingly affect every function and role. We need to help people develop the skills they need to take advantage of what we can offer now and in the future.* ***DO02***

The strategic decision made at the senior leadership level influenced the future directions of the company and how it would operate in the challenging digital environment.

### *5.2.2 Resources (CF.2)*

#### *5.2.2.1 Big Data as a New Resource (opportunities and challenges) (CF. 2.1)*

- ***Big Data Opportunities***

The interviewees' perceptions of the benefits of Big Data to the company were identified as the critical determinants of Big Data adoption throughout the project. In particular, at the preparation phase, Big Data was expected to be the driving force for the digital transformation of their business by creating market opportunities, enhancing operational efficiencies, and reducing the timing and costs of the entire business cycle (from research and development to the market). It was acknowledged by almost all participants that Big Data, as a new resource, has the potential to completely change the traditional way of undertaking research and discovery, the way in which the company commercialises its products, and the way in which the company serves its patients. Informants believed that implementing Big Data solutions would enable the company to accelerate and reduce the cost of the entire business operations cycle. The Senior Director of Data Governance from the Global site shared the following view:

> *Big Data is big opportunity for a company like us, which is focused on sort of personalised medicine. You know getting insights about our patients and about the diseases. Operate in real world and optimise our drugs that are already in the market. That's a great opportunity.* ***IG04***

It should be acknowledged that the personalised medicine being referred to by the above participant might also be termed *genomic medicine* or *precision medicine*. However, they all refer to an approach that emphasises the ways in which patient disease risks are unique and different, among other characteristics. Those disease risks are based on *the predispositions written into patient's genome at birth, combined with his/her lifestyle and environment* (Costa, 2014).

Big Data as a new resource was perceived to influence early R&D phases. For example, with modern genomic data, participants believed that what previously would have taken months or years to develop in a research lab, can now be made available in a significantly shorter time. For example, the Vice President of IKU for the project expressed the view that:

> *Big Data is everything under the sun, you know we can get better at drug discovery, faster, do it more economically, but the biggest impact that we can make as a company is currently anchored around patient data.* ***IG05***

Regarding the precision of patient data, participants believed that Big Data analytics would enable the company to look into a patient's DNA and identify how biomarkers responded to their drugs, or to monitor the effects of a particular drug, with significant consequences for drug development. Here, a *biological marker* refers to a broad subcategory of medical signs - that is, objective indications of medical state as observed from outside the patient which can be measured accurately and reproducibly (Strimbu and Tavel, 2014).

As the Senior Director, IT Enterprise Arch, IT Admin within the company explained:

> *Drug development has to be much more data-driven and has to expand far beyond randomised clinical trials to start embracing these different datatypes that are now proliferating and available. We said it is clear we as company need to get much better at being able to connect data and apply analytics to glean insights around our patients.* ***IG03***

However, despite Big Data being a critical corporate asset, its value is tied to its ultimate use. The ability to manage and integrate data generated at all stages of the business cycle, from discovery to real world use, after regulatory approval, is a fundamental requirement to allow the company to gain benefit from Big Data trends.

- ***Big Data Challenges***

When introducing Big Data initiatives, the size and global operational environment of the company resulted in specific challenges being posed, such as having to deal with numerous legacy systems, and cultural differences. Other examples included data privacy and security, budget, operating capabilities, and system integration (some of which will be discussed later in this chapter).

However, one of the most challenging issues to be overcome during the preparation and building phases were identified as the legal, data coordination, and harmonisation issues. As the Senior Director, Data Science IKU explained:

> *So one challenge is the legal aspect for getting access to data in Europe for example is very difficult and there's many limitations around data protection and anonymization and consent and all those kinds of things. So, that's on two levels, the*

*first issue is Legal issues and the second issue is… I think it's coordination because every country within the company bubble is already doing their own thing and already have relationships locally with data providers, universities, governmental registries, whatever.* ***IG07***

Despite the recognised opportunities and challenges, participants acknowledged that the subject of Big Data is very new and complex. "Best practise" guidance on adoption and implementation of Big Data initiatives is yet to be developed as Big Data remains a relatively new phenomenon.

*Big Data is new phenomenon, the ecosystem is learning. It's a good starting point, let's now identify what else we need, and collaborate with our partners and see how we can get there. So that is one observation. The other observation I've seen is, all this data or collaboration that we have, none of them have a business model, to be blunt. I think it's a new industry that's evolving, and it's defining itself, so probably in the next few years I think you'll see new types of companies emerging.* ***IG05***

#### *5.2.2.2 Other Resources (CF.2.2)*

Recent studies on the creation of new capabilities for Big Data argue that in addition to tangible resources such as data and analytical platforms, senior managers and technical staff should also be viewed as resources crucial to overcoming Big Data challenges (Gupta and George, 2016). Indeed, a firm's value-creation strategy lies in its heterogeneous resources (Wernrfelt, 1984; Barney, 1991; Peteraf, 1993). This was clearly evident in the case study company. The important role played by the senior managers at the planning and preparation stages in order to overcome Big Data challenges was highlighted by a number of participants. Senior managers who had a clear vision for the Big Data project teamed up to form the "*IKU Champions*" group to lead the project to success; participants referred to these individuals as *Big Data evangelists*. The main idea of the IKU/Big Data project at this stage was to identify opportunities for Big Data within the business and to pioneer a new way of working by utilising this new resource.

In particular, to help the company learn how to embed Big Data into their functions/franchises and day-to-day activities.

The Executive director of the project recalled:

> *It was a group of 20 individuals across 7,500 global individuals, where we're trying to influence and change the way we think. Right? And what we've found in this journey is we will not be successful with an approach of forcing people to do this. Where we've found success is finding what we refer to as like-mindedness. Start with the people, having many conversations, right, and meetings and communication plans and things, but start to attach ourselves to those people who think alike, think like us start to show the return on investment.* ***IG01***

However, at the beginning it was the senior leadership team who strategically approached the Big Data initiative and set out a vision for its implementation. The Vice-President of the project commented that:

> *Definitely decided at a strategic level, and we mangers aligned on, okay if that's the world we want to be in, how do we get there? We've made a strategic choice is to build these foundational capabilities, which are really around the Big Data platform, around certain strategic partners, that we think we need to have.* ***IG05***

The Executive director of the project also added:

> *A senior leadership team that identified this as a priority, and I think without that it would be very difficult to do anything, purely because there's so many competing priorities within the organisation. In order to create a transformative capability, you need the most senior-level people saying okay, I know we have a lot of things going on, but this is one thing that I want you to make sure that you try to embrace, and you try to see the applications of this within our organisation* ***IG01***

***- Increasing Awareness and Building Trust***

One of the obvious findings from the data was that the case study company had achieved commitment to the project from both the key members of staff and others throughout the organisation. The importance of all members of the organisations participating in new initiatives in addition to the commitment made by senior management has also been widely argued and agreed on in the literature (Ryals and Knox, 2001; Rigby and Ledinghan, 2004). This kind of universal commitment can be achieved by increasing the awareness of the benefits and the value of such initiatives. Participants pointed out the importance of improving the awareness of Big Data opportunities at every level of the company. They believed that it was important that everyone clearly understood what a new initiative could bring, and its benefits to each function of the company such as marketing, development, and clinical trials.

As the Associated Director of IT, IT EA and Information Management explained:

> *It is less about training but it's more about awareness and education. And so, then it's going to the business leaders and the business teams to say hey, when you have these types of questions, we've now built skillsets along with the technology within your team to answer these in a new and different way.* ***IG02***

The same participant added:

> *What ended up happening though, is that as we started to increase the awareness about that foundational capability that we were building, people really started to really hear about the project. We started to do education across the company, and that's when the business opportunities started coming. And then at some point they started coming, like a lot of them, in which we actually had to build out a process.****IG02***

This widespread awareness was achieved by clear and increased communication, education and, training activities. For example, the Director of Knowledge Utilisation believed that:

*I think communication is critical for showing the business value, right. So the way IKU program started is we compiled a list of business opportunities across all of the company as part of the strategy project. And then we prioritised them, and started working on the top priority one, and started to show some value. So I think that is how we got buy in from, you know, certain business areas, where we were able to deliver value. Saying hey, this is interesting. I'm interested in continuing to invest.* ***IG02***

In other words, knowing what could be gained from a new solution makes it easier to understand what capabilities need to be developed in order to implement the change. For example, during the implementation process, project members provided real-time updates on the status of the development via dashboards. This practice helped the project team demonstrate the progress of the IKU project and to communicate business opportunities to the company.

At the same time, participants also highlighted that all communications should be considered carefully, as at the early stages of the project there tends to be resistance, or even objections of one kind or another. For example, the Senior Director Data Governance IKU pointed out that:

*I think the greater opportunity is sharing the vision and what does it mean for them. However, one of the challenges I think is you have to be careful about gloating or being too positive, right, because not everything is working and we're learning from the journey, so your communication has to be very pinpointed in the beginning, but you also have to be aware that there's people that are going to say or bring negativity on this type of programme.* ***IG04***

In addition, education, training, and skills development in Big Data initiatives helped to win the trust of employees when new resources and processes were introduced within the organisation.

The Vice-President of Global Planning and Tech Ops, IT GOS Admin believed that:

*As well as the education, the training, the communications to start building the acumen of people around the organisation so that they know enough about what these new resource and capability' are. And they can just connect the dots on maybe where they might be places that can think differently about how we currently do things and apply this to do it differently*. ***IG06***

The importance of increasing awareness and demonstrating value was also highlighted by the Executive Director. She explained that:

*Because we have fixed capacity we want to make sure it's something that that part of the organisation feels like is appropriate for them, and something that they feel it is worth allocating their business opportunity to. And that if we answer that, if we work on that, that part of business will have a good understanding of what this opportunity is, so that they can start building it within their part of the business.* ***IG01***

With *fixed capacity* the informant was referring to the company's silo data management approach across different factions and franchises (this will be discussed in later sections). She believed that influential factors for in the development or the enhancement of existing capabilities for effectively using Big Data are: awareness, commitment and shared vision.

*You know, while there was a realisation in certain parts of the company, a lot of people who are day to day saying, my world is okay. I mean, we are delivering, we are growing, like what are you trying to change? So there is a mind-set shift that is required for people to give up their data, and accept and commit in governance, and think differently, right? Become more data driven.* ***IG03***

With regards to this point the Associated Director of IT, IT EA and Information Management added:

*So we went through a positioning effort and really identified that we want to enable the teams. We want to change their mind-set. We want to change how they integrate* *data into their day-to-day work flow. We need shared vision. This is the new model going forward, and if they don't, and if we don't create this as a sustainable capability, this will fall. It will just be the next fad, and we will actually not have the uptake and the transformation that we want to see.**IG02***

***-Path Dependencies***

In addition to the factors laid out above, such as tangible and human resources, increasing awareness, and effective communication, interviewees also credited the company's culture with supporting challenging initiatives and developing new capabilities. A collaborative spirit, based on flexibility and focus on company values, were found to be positive drivers for the project.

As the Senior Director Data of Governance, IKU expressed:

*I think the culture generally is very collaborative good ideas and sort of different way of approaching things is generally acceptable. So those are strengths. It's also a very consensus driven culture meaning we strive hard to get everyone's buy in.* ***IG04***

Still on the subject of recognising the value of the organisational culture helping the company to achieve technological changes, the same participant explained:

*I mean our core is passion for the patients. We are producing drugs and positive outcomes for patients, but technology may be the way for the future for that to happen for patients. And that's what's different about our company culture. We focus on the patient, and good things will happen if we focus on the patient.* ***IG04***

Although some of the informants emphasised the importance of the general organisational culture, it has been acknowledged that national trends and other boundaries created cultural differences within the corporation, making it a challenge to convince everybody to accept innovative ideas and change.

The Senior Director of Data Science, IKU acknowledged that:

> *Communication between different countries is very tricky problem as we operate multiple time zone and culture. Sometimes there are people with individual objectives. So communication and sharing ideas are significant challenge.* ***IG07***

However, the Executive Director of IKU also believed that:

> *I think the company has had a culture that's been very entrepreneurial. It's challenging now because as we grow. But there's a lot of empowerment of individual teams and people to take risks, to try things that are new. You know you make a mistake once, and that's okay, you make a mistake maybe two or three times, then we should look at it. And so that allows you to do these types of transformative things because people have an appetite for it or a desire to do it.* ***IG01***

Organisational culture appears in this case to have stimulated some aspects of the pursuit of an innovative cross-functional Big Data project while inhibiting others. The company culture was, perhaps paradoxically, considered the biggest commonly-acknowledged challenge for the project. The ability of the company's culture to adapt and transform in response to the opportunities and challenges presented by Big Data emerged from the data as an essential factor for the successful adoption of new Big Data capabilities.

Opportunities provided by new technological approaches and solutions, like the company's new data connectivity platform, '*Synapse*', along with skills and data analytics (which will be discussed later) had a transformational impact on the application of data initiatives within the company. However, the greatest challenge that emerged from the data did not involve technology and required skills, but rather was the process of cultural transformation at the planning stage.

The issue of cultural transformation was related to people who were not prepared to change their mind-set regarding data silos and the acceptance of new Big Data initiatives. The Director of Knowledge Utilization shared her thoughts as below:

> *I think the biggest challenge is changing the culture and breaking down the silos in order to really gain operational efficiencies. And I think the third is having people be able to understand what this is and see how it can truly transform and think completely differently in how they do what they do.* ***IG02***

With regards to this issue the Exclusive director of IKU also expressed her concern as:

> *We are already a silo organisation, which makes breaking this barrier and changing this mind-set even harder. We're not there, and that's I think… Unfortunately it's something that's so critical to get right. Unfortunately like there's so many other things that we always need to do that it doesn't get enough resources.* ***IG06***

Almost all informants identified changing people's mind-set regarding data silos as a major ongoing challenge for cultural transformation. Analysis of the data bears out the idea that for an organisation to become more data-driven there would need to be a shift in mind-set throughout the company. The biggest breakthrough made by this company in this regard was to break down the existing "silo" mind-set within the organisation as a whole, and an example of the activities pursued to this end was the company's *immersion/experience practice* (which will be discussed in detail in section 5.6) that was conducted as part of the learning activities. The Senior Director of Data Science commented that:

> *Important is changing peoples' mind set, because you know, a lot of the times… You know, while there was a realisation in certain parts of the company, a lot of people who are day to day saying, my world is okay. I mean, we are delivering, we are growing, like what are you trying to change? So there is a mind-set shift that is*

*required for people to give up their data, and sort of participate in governance, and think differently, right? Become more data driven.* ***IG07***

As we have seen, shaping the Big Data culture depends on changing the mind-set of people, which itself is influenced by the existing organisational culture. Development of a Big Data culture is an incremental process, and the need to enhance or develop new capabilities to effectively use this new resource emerges from this gradual process. Analysis of the data indicated that having a suitable mind-set would allow people to collaborate and participate in data governance, to use data more efficiently, to think differently, and to change the way they integrate data into their day-to-day workflows. Participants believed that connectivity, clear communication, and coordination would avoid duplication of activities within different functions and different countries. As the company's Vice- President concluded:

*It all starts with pioneering a new mind-set with how data management and technology come together to impact and inform various ways of working. We are launching a number of different communication, education, and collaborative communities of practice to help increase the knowledge on the Big Data initiatives.* ***IG05***

### *5.2.3 Existing Capabilities (CF.3)*

Alongside the challenge of cultural transformation discussed above, another ongoing concern that emerged from the data was that of arranging and matching the existing organisational capabilities effectively within the digital environment.

Different organisational capabilities (e.g., management, technology, marketing, HR) are grounded and mutually supportive in achieving a firm's different operational activities (Akter and Wamba, 2016). As has been indicated several times in this report, one of the biggest issues that was highlighted by the participants was the company's silo data management approach. Every department (e.g. medical affairs, commercial, market access, IT) had their own data sets. Each function had different goals, priorities, responsibilities, and systems. Thus, each function was focused on delivering their own business outcomes, and although this was highlighted as one of the core strengths and capabilities, all participants agreed that in the case of Big Data initiatives even the company's very strong existing operational (marketing and IT) capabilities for discovering, developing, and commercialising compounds needed to be reviewed.

#### *5.2.3.1 Marketing Capabilities (CF. 3.1.1)*

Marketing researchers have conceptualised marketing capabilities in terms of a firm's ability to use available resources to perform marketing tasks in ways that achieve desired marketing outcomes (Morgan et al., 2012). They therefore represent the integrated processes in which a firm uses its tangible and intangible resources to define, develop, communicate, and deliver value to its target customers (Morgan et al., 2012). The integrated processes mentioned above were clearly evident in the case study company's documents and participants' responses.

The company sought out talented people and creative partnerships from more than 50 countries to grow their business. This enabled the company to develop collaborative solutions to bring together patients, healthcare providers, and policymakers to find solutions for better treatments and to deliver value to its target customers.

As one of the interviewees highlighted:

> *One of the things that I think is really apparent. You know we're a $100 billion-plus market cap company with 7,500 employees globally. So you have a lot of different hats, a lot of different responsibilities, and it's really, at the core of it is an entrepreneurial type of atmosphere. One of the advantages of the company is ability taking that across the entire lifecycle of what we do is also sharing that with partners.* ***IG04***

The ability to bring different talents together to serve targeted markets was also acknowledged in one of the company's documents as a crucial factor in being successful.

> *Our success is dependent on our ability to develop effective collaborative solutions from an "ecosystem of innovation" – bringing together patients, healthcare providers, industry, academia, payers and policymakers – to find solutions that can change the world for the better.* ***DO01***

Furthermore, regardless of the challenges linked to the Big Data cultural transformation, other good examples of the company's marketing capabilities were its ability to operate globally, to develop knowledge of different markets, to spend time experiencing different local cultures to understand complex needs and behaviours of customers (Day, 2011), to successfully launch new products and customer relationships (Ryals and Knox, 2001), and to create successful marketing approaches (and to overcome the setback of unsuccessful marketing approaches).

As one of the participant pointed out:

> *The main strength I think is… You mentioned a few things there. I think it's a little bit of all of that. For example, segmentation is just one part of it, you know, the marketing paradigm and segmentation in therapeutics is going to be very significant, right? I mean, we've made a drug… we've just released a drug a month ago which targets probably about 15,000 patients in the world, you know, of the 7 billion patients. So, that's based on one tiny mutation, the IDH mutation, in acute… in a leukaemia.* ***IG03***

In total the company's discovery and development of innovative life-enhancing therapies were established in four major market segments and service areas; namely, *Hematology/Oncology, Inflammation, Immunology,* and *Cellular Therapeutics*. These biopharmaceutical and healthcare market segments served the global patient population through the specific products in each segment (Annual report, 2016).

The ability to offer patients different options for enhancing their quality of life was the strongest marketing capability within the company. Perhaps the ultimate example of this ability was their bringing to market a new product called '*Revlimid*' for patients who have serious rare diseases and few treatment choices. '*Revlimid'* is an oral immunomodulatory drug approved in the United States and many international markets (Annual report, 2016) and has become a key element of the treatment of multiple myeloma.

Furthermore, delivering innovative therapies to different markets that lack proper infrastructure and pursuing regulatory approval of new options in the treatment of rare diseases are other great examples of the company's existing marketing capability. Another of the company's treatments, *'Otezla'*, has after three years on the market established itself as an advance for physicians and patients in the care of plaque psoriasis and psoriatic arthritis (Annual report, 2016). Reflecting on the product's 116% increase in sales in 2016 to a total of more than $1.0 billion (DO03), it was believed at the company that this treatment reshaped the way these diseases are treated in their early stages and met a previously unmet clinical patient need. It was evident in one of the company's documents that, with persistence and creativity, the company was able to transform some of the drugs and treatments into new hope for patients in need. As the document stated:

> *Underlying each of our development programs is a clear mission to create novel, life changing therapies that have a substantial impact on the most critical health needs facing society. In 2016, our efforts to improve the lives of patients worldwide led to: More than 500,000 patients receiving at least one of our seven medicines.* ***DO03***

The company also went further, not only using a particular product to create a sustainable relationship with customers, but also providing them with different services. These included: up-to-date and precise information about their drugs and services; online product resources; and information and publications to doctors, scientists, and healthcare professionals. Figure 5.1 below presents a summary of the company's customers and related activities.


*Figure 5.1: The Case Study Company's Customers and Related Activities (source, the company's Responsibility Report, 2016)*

Engaging in active communication with customers and providing them with up-to-date information are believed to be important in creating trust and maintaining customer loyalty. Furthermore, as the Senior Director, IT Enterprise Architect explained, to insure that the company's products and services are safe and customers are well informed, the Global Drug Safety and Risk Management (GDSRM) department was involved in every step of these processes, from inspection to marketing.

As one of the documents indicated:

> *Giving them information that is helpful to them will help them remember you as a trusted, valuable resource. An easy way to do this is to send a regular email newsletter that helps, not sells, to them.* ***DO03***

During the interviews most of the participants highlighted the importance of social media for communication with customers, as well as monitoring brand success, or that of competitors.

Referring to social media as a source of communication, the Senior Director of Data Science commented that:

> *There are various ways you can use social media to leverage customer satisfaction. You can monitor brand mentions, use them as a customer support channels, and even hold live interactive sessions with customers.* ***IG07***

Furthermore, the company's engagement with patients via the company's Twitter or Facebook pages as a means of developing strategies according to customers' needs demonstrated the company's understanding of the trajectory of those needs through effective information acquisition, management, and use. The company's efforts in the continuous improvement of environmental, social, and economic performance included innovative methods for patient support and advocacy, personal interactions, and support for new programs in local communities.

Examples included:

1. Directing patients to navigate the challenges of insurance and Medicare coverage to ensure they have access to the medicine they need
2. Launching in 2011 the successful program *'Patients' Partners'* in which the company works in close collaborative partnership with patients and professional Advocacy organizations to share ideas and discuss how the company and advocates can work together to improve the lives of patients and their families worldwide
3. Activities for risk management. The company introduced a number of innovative features to support prescribers, pharmacies, and patients. One of the interesting examples of this activity was that upgrades into their internal call centre technology reduced the time taken to complete Risk Evaluation and Mitigation Strategy (REMS) enrolments and surveys. Furthermore, successful launch of a pharmacy Web portal resulted in more than 80 percent of all the company's pharmacy REMS tasks being

fulfilled online.

As the Executive Director of IKU commented:

*We have an unrelenting passion to provide world-class customer service to those completing the company's REMS tasks, and we've launched additional innovative technologies, such as a REMS mobile application, to achieve this goal.* ***IG01***

It has been argued that advances in technology and organisations' existing marketing capabilities allow organisations to capture rich and newly-available sources of information (Big Data) that help identify gaps in their understanding of consumer behaviour and utilise it strategically (Erevelles et al., 2015). The company's ability to recognise such gaps was made evident in the interview data. Speaking about the company's marketing capabilities and the potential of Big Data, the marketing director explained that the company currently holds clinical data at the patient level and has a controlled distribution process for some of their drugs, meaning that interaction with patients is conducted in a controlled manner. For example, in the US, market access to drugs, and payment for those drugs, are often controlled by third parties, resulting in an arrangement whereby drugs are only prescribed or paid for if they meet certain criteria. With the use of an additional source of information like Big Data, she believed that the company could better demonstrate that their drugs will work in a certain patient type and that achieving those results could prompt increased transformation of the target market. (*Target market* here denotes the end consumer to which the company wishes to sell its end products). Although some concerns had been expressed about the cost of getting a drug to market and the need to guarantee a return on that investment, she explained:

*I see the market transforming. It is going to be a pay-for-performance type of environment going forward. But if you think about the cost of getting a drug to market and the return on that investment, and if we're not able to shorten that, costs are going to continue to grow. And as a result of that, the markets are becoming smarter* *and data I think will help us be more targeted in again whether something's going to work for a patient or not. You pay for performance.* ***IG01***

One of the company's first focused uses of Big Data involved obtaining a “360 degree view” of the patient - clearly indicating the company’s customer orientation. This refers to a holistic profile of the patient, including the patients’ tasks, treatment timelines, progress, and future appointments. This enhances decision-making, supports optimal treatment, reduces avoidable errors, and improves outcomes (Frost & Sullivan, 2017). Lockrey (2015) suggested that the market orientation of a company, which defines how it is focused in relation to customers, competitors, and departmental dynamics to deliver success, defines the effectiveness of an organisational strategy and organisational capabilities. Thus, the company’s dedicated customer orientation can be viewed as inseparable from its strong marketing capabilities. Moreover, monitoring and managing competitors was another marketing orientation that was captured in the participants' statements and the company’s documents. For example, during the interview Director Knowledge Utilization recalled:

*We were trying to understand, like, how is our drug performing against our competitors’ drugs, or how can we prove to the insurance that our drug is more effective than our competitors drugs*. ***IG02***

Departmental coordination, which was linked to the change of mind-set regarding data silos, was a “work in progress” marketing activity within the company. Almost all participants acknowledged that what they were missing was the ability to coordinate different functions and franchises (Marketing, IT, policy, different countries). For example, they believed that with an ability to combine CRM data with what physicians were saying with real-world data, they could generate different types of insight. Furthermore, they believed that if data from randomised trials (that is, information about every patient who took their drugs when testing a new treatment) were combined with real-world data, they could obtain greater insight into patient behaviour. Early signs of such activities were discovered at the operational phase, after the implementation of the *Synapse* platform (which will be discussed later in this chapter).

The company's marketing capabilities are summarised in Table 5.1.

| Definition (marketing capabilities) and examples in the literature (Authors) | Operational Capability | Appearance in the Case Study | Direct quotes (comments) from interviews and secondary data comments |
|---|---|---|---|
| Marketing capabilities are an integrated process (e.g. building sustainable relationships with customers, having knowledge of competitors, and possessing skills in market segmentation and targeting) in which the firm uses its tangible and intangible resources and capabilities to understand the trajectory of customer needs via effective information acquisition, management, and use (Day, 1994; Dutta et al., 1999; Song et al., 2007; Krasnikov and Jayachandran, 2008; Morgan et al., 2009) | Integrated process, in which the firm uses its tangible and intangible resources<br><br>Offer patients different options for enhancing their quality of life<br><br>Build sustainable relationships with customers<br><br>Communication with customers via social media | -Operating globally, in over 50 countries<br>-Creative partnership to grow the business<br><br>Delivering innovative therapies to different markets.<br><br>Add value to people's/patents' lives by not only providing a service, but also giving them information that is helpful to them. | *Ability to develop effective collaborative solutions from an "ecosystem of innovation" – bringing together patients, healthcare providers, industry, academia, payers and policymakers – to find solutions that can change the world for the better.* ***DO01***<br><br>*With persistence and creativity, the company was able to transform this maligned drug into new hope for cancer patients in need.* ***DO03***<br><br>*Giving them information that is helpful to them (not only to your business) will help them remember you as a trusted, valuable resource. An easy way to do this is to send a regular email newsletter that helps, not sells, to them.* ***DO03*** |
| | Understand complex customers' needs<br><br>Understand the trajectory of customer needs through effective information acquisition, management, and use | Experiencing different local cultures, customer needs and behaviours. The company's engagement with the patients via the company's Twitter and Facebook pages<br><br>Listening to what the customers are saying on their Facebook and Twitter pages, and developing strategies accordingly | *Communicate, communicate, communicate Social media is key. Today, more and more customers connect with a brand through social media platforms. There are various ways you can use social media to leverage customer satisfaction. You can monitor brand mentions, use them as a customer support channels, and even hold live interactive sessions with customers.****ID03*** |
| | Knowledge of the competition<br><br>Monitor brand success and competition | Monitoring and managing competitors | *We were trying to understand, like, how is our drug performing against our competitors' drugs, or how can we prove to the insurance that our drug is more effective than our competitors drugs.* ***IG02*** |
| | Skills in segmenting and targeting markets | Controlled distribution process for some of their drugs. For example, in the US the market access to drugs and payments for those drugs are often controlled by third parties, | *Segmentation is just one part of it, you know, the marketing paradigm and segmentation in therapeutics is going to be very significant, right? I mean, we've made a drug. we've just released a drug a month ago which targets probably about 15,000 patients in the world, you* |

| | | | |
|---|---|---|---|
| | | resulting in an arrangement where drugs are only prescribed or paid for if they fulfil certain criteria | *know, of the 7 billion patients. So, that's based on one tiny mutation, the IDH mutation, in acute… in a leukaemia.* ***IG03*** |

*Table 5.1: The Company's Marketing Capabilities (CF 3.1.1) (Author's own)*

#### *5.2.3.2 IT Capabilities (CF. 3.1.2)*

An organisation's IT ability, in combination with other organisational resources and capabilities, a significant role in the assembly and deployment of IT based resources such as Big Data. Such an ability enhances the organisation's current (operational) capabilities and enables new capabilities development (Bhardwaj, 2000). Examples of such abilities include business process re-engineering, integration of the required IT into the appropriate business processes, customer relationship management, electronic commerce, adoption of new resources, and management of digital data (Bhardwaj, 2000; Gupta and George, 2016; Wamba, 2015 ).

The Senior Director of IT Enterprise Arch, IT GOS Admin explained that IT capabilities as an integrated on-site function was one of the core capabilities of the company. For example, engaging in e-(electronic) commerce with suppliers was given as a good example of the company's effective IT capability, while so-called E-sourcing allowed the company to achieve consistent and transparent global processes. Furthermore, data quality checks and good information management, along with CRM capabilities, were highlighted as important IT capabilities at the company. Another example was that of the company's wide data access protocols, put in place to ensure data security and to minimise the risk of data being used inappropriately. As a participant explained, the company's IT capability had previously been limited to supporting interactions with business partners and related stakeholders, but there was an identified need for an *end to end*, integrated IT solution that would let the company collaborate, connect, and share Big Data solutions with others in the organisation and across the supply chain. Even though the existing structured data management processes for clinical trial management and data capture were given as examples of the company's existing IT capabilities, it was widely agreed that there was a need for the enhancement or development of new capabilities to support Big Data initiatives.

As the Senior Director of IT Enterprise Arch, IT GOS Admin commented:

> *We have a basic building blocks of the capabilities and I mean there is a room to grow all , I mean we have IT infrastructure in place data science expertise are there and we have a core data scientist expertise you know we need to build that out and continuously build it into business as well.* ***IG03***

In addition to the company's existing capabilities, implementation of the *Synapse* platform was a fundamental step in the Big Data adoption process. Incorporating a new cloud-based platform into the company's existing environment entailed an evolving learning process, and demonstrated the efficiency of the company's new resource adoption and resource management capabilities (another important IT capability). As one of the senior leader related:

> *So I look at it as, as you build the foundation capability, you make incremental operational efficiencies. As you move along the curve of establishing your foundational capability, and really getting it off the ground, that is when in the longer term you can start to see transformation.* ***IG05***

Regarding data management, the IT and data governance director explained that some of the important steps for data taxonomy, data quality checks or good information management were already in place. For example, a controlled distribution process for some drugs that allows the company to work directly with the patients through a controlled process. However, participants also acknowledged that the growing complexity of the data - whether involving molecular structures, genomics, electronic medical records, or payment information demands – demanded the use of different skill sets. Therefore, in many cases it is important that a company advances existing IT capabilities. As he commented:

> *We have a very nice data footprint in the company however there are the gaps. I mean that's what we are doing coactively to identify what are the gaps and how we will go out and how we exactly will build them.* ***IG03***

With regard to other IT capabilities, it was acknowledged that technological foundations needed to be developed or enhanced that would lead the company to support an analytic environment and improved data governance and data management skills.

***- Ability to lay the technical foundation and connectivity***

Empirical investigation confirms that different experiences can result from the use of Big Data, with some being the consequence of the use of different technologies, and others the result of benefiting from the opportunities Big Data offers. It has been pointed out that in order to make full use of Big Data with its volume, variety, and velocity, investment has to be made into new, capable tools and technology, as existing IT platforms are not always designed to address Big Data-related technological challenges (Morabito, 2015).

A traditional data infrastructure of the sort that relies on centralised warehouses of structured data and which is optimised towards addressing a specific problem for a particular business unit does not allow much connectivity with different part of the business. Even more importantly, it does not allow a cultural move away from the traditional data silo mentality to more open thinking.

Novel solutions, such as cloud-based Big Data platforms, are starting to gain ground as promising new approaches to informatics, resulting in a drive away from traditional data rule-based statistical approaches to more powerful machine learning, data-driven approaches. Findings from research have suggested that a platform that can work across functions, which can consolidate diverse data assets, and which features useful analytical tools, would represent a vital foundation for building Big Data capabilities within a company. The case study company found for itself that a connectivity platform that supported data harmonisation, data governance, data standards, and data privacy and security helped enable the company to build Big Data capabilities.

> *Data Harmonization and our Big Data Platform, Synapse, will become the standard that connects all data environments across the company enabling the company to easily connect disparate data sources to generate data-driven insights at our fingertips. Data Harmonization is the backbone to be able to deliver on data-driven decision making the ability to connect data.* ***DO01***

Indeed, as the Senior Director of IT Enterprise Arch, IT GOS Admin stated:

> *We didn't have a cloud-based analytic environment, and even like a service catalogue where you could say, if I have a data question do I actually know what data we have? It's the beta system. Same thing as data governance, didn't exist, or even if it existed it wasn't really, there was no discipline around it, so it's basically the same end result. So that's what we've put in place.* ***IG03***

Various informants agreed that development of this type of platform was a fundamental step in the Big Data adoption process. The logical next step would be to identify what else would be required to carry on with successful implementation of the process. As one of the participants asserted:

> *So I look at it as, as you build the foundation capability, you make incremental operational efficiencies. As you move along the curve of establishing your foundational capability, and really getting it off the ground, that is when in the longer term you can start to see transformation. But it's not until you have the foundational capability in place, that's [unclear], the data, the skillsets, that you can achieve that transformation. So I think where we are in the process, we are starting to see*

*operational efficiencies within the business, but the transformational changes is still work in progress.* ***IG01***

***- New Skills***

The introduction of a new IT platform and related technology would require the development of new skill sets in any organisation. Without correct knowledge and capabilities to utilise the new technology and the vast data sets it would make available, this project would not have progressed into the operational stage. As one of the consultants commented:

> *I think it's not technology that would be a challenge it's a talent issue because. this is new space data scientists are not like you know easily available and managing this type of environment is different that managing the traditional IT computer environment so I thing, that challenge is there will come will be based on business demeaned and greater that domain the challenge will be in terms of talent peoples skills* ***IG08***

Another participant also opined:

> *So, if you have the greatest tool and technology but you have no-one actually knows how to work with it, it's just the greatest tool, and basically it will go by the wayside. Pharma even does not has the skills to evaluate this new technologies so it is which talent gap that pharma needs to answer it* ***IG06***

Indeed, the talent gap was highlighted at this stage as one of the obstacles, although opinions varied between participants about the best way to fill this gap. One of the senior leaders believed that although staff training was an effective solution, the dominant practice was to hire or recruit new skilled talent. On this subject the following opinion was offered:

*Learning can be piece of it but I personally think that for pharma it's better to get this new talents who look at world in an different way and they has been trained differently to looked at data through different lens than to try train people* ***IG07***

However, during the interviews it was also acknowledged that, together with bringing in new skills, investment must be made to support staff training and learning. Therefore, some managerial and organisational processes, such as re-configuration, learning, coordination, etc., had their part to play in supporting Big Data transformation in the company.

The company's key IT capabilities are summarised in Table 5.2 below

| **Definition (IT Capabilities) Examples in the literature (Authors)** | **Operational Capability** | **Appearance in the Case Study** | **Direct quotes (comments) from Interviews and Secondary Data Comment** |
|---|---|---|---|
| An organisation's IT ability, in combination with other organisational resources and capabilities, a significant role in the assembly and deployment of IT based resources such as Big Data. Examples of such abilities include business process re-engineering, integration of the required IT into the appropriate business processes, customer relationship management, electronic commerce, adoption of new resources, and management of digital data (Vitari et al, 2012; Chen et al., 2012; Wilden and Gudergan, 2015). | Integrate required IT into appropriate business processes<br><br>E-commerce<br><br>Ability to lay the technical foundation and connectivity<br><br>New resource adoption and management | IT capabilities as an integrated function of the allow end to end visibility across the value chain. This enables the company to connect processes and platforms across all functions<br><br>Data quality checks or good information management. For example, the company had company-wide data access protocols to ensure data security and to minimise the risk of data being used inappropriately<br><br>E-sourcing, doing business with suppliers. Speeds up the process by shrinking sourcing cycles. Maintains transparency in their process. Results in a consistent global process<br>A suitable platform in place that has the capability of working across functions, which consolidates various data assets, and which features useful analytical tools, was found to be an essential foundation for building Big Data capabilities within the company.<br>The *Synapse* platform was a fundamental step in the Big Data adoption process. Implementing the new cloud-based platform into the company's existing environment was an evolving and learning process, but | *I mean we have IT infrastructure in place data sciatic expertise are there and in some extend we have a core data scientist expertise you know we need to build that out and continuously build it into business as well.* ***IG03***<br><br>*As a part of the company's Strategic Sourcing process we look forward to employing best in practice tools and methodologies. For example E-sourcing helps us evaluate all relevant business criteria's and not just cost.* ***ID03***<br><br>*So I look at it as, as you build the foundation capability, you make incremental operational efficiencies. As you move along the curve of establishing your foundational capability, and really getting it off the ground, that is when in the longer term you can start to see transformation. But it's not until you have the foundational capability in place, that's [unclear], the data, the skillsets, that you can achieve that transformation. So I think where we are in the process, we are starting to see operational efficiencies within the business, but the transformational changes is still work in progress.* ***IG01*** |

| | | | |
|---|---|---|---|
| | | indicated the efficiency of the companies existing IT capabilities. | |

*Table 5.2: IT Capabilities (CF 3.1.2) (Author's own)*

### *5.2.4 Dynamic Capabilities (CF.3.2)*

#### *5.2.4.1 Strategic Competitive Response (CF. 3.2.1)*

As was outlined in the literature review (Chapter 2), in a digital environment, where technological innovations require fast organisational responses and changes, dynamic capabilities become a tool that allows firms to build and renovate operational capabilities (Danneels, 2010; Teece, 2007; Pavlou and El Sawy, 2011; Protogerou et al., 2011; Braganza, et al., 2017). One of the important aspects that was captured from the interviews is that the company had an existing ability to scan the business environment, identify new opportunities offered from Big Data, assess its competitive position, and forge a link between needs and solutions. The way participants recalled how they started Big Data initiatives confirms that the company was able to scan and seize such new opportunities. As the Executive director of the IKU project recalled:

> *IKU probably started seriously about two years ago, so 2015, and it really was the result of a lot of hallway conversations between very senior leadership, saying there's a lot of noise going on about you know Big Data and you know we have a sense of what it is but not really a good sense of what it means for us. What we should do about it, if anything. And then they assembled a very small team. And really what our task was, was to figure out this world of Big Data and tell us what we need to do about it.* ***IG01***

The interview data analysis confirms that within the company a lot of strategic thinking and proactive conversations regarding Big Data were taking place before the project started. For example, the Director Knowledge utilization recalled:

*So we did a little bit of diligence. And that diligence resulted in over you know it was 150 use cases across the organisation. So we had a good idea that there was a lot, that it seemed like our teams thought that we could do with this. That this was something that could fuel a lot of different areas. And we also knew that there were a lot of questions.* ***IG02***

Strategies tended to focus on predicting the environment, positioning the project planning, and establishing the effects of initiatives. This combination helped achieve understanding of what was needed and what needed to happen in order to drive the project forwards. For example, some of the identified needs were as following: new skillset, data scientists, and data vendors, along with strategic partnership and education.

*We need the right skillsets, like the data scientists, like the data wranglers, the taxonomists, the Big Data IT professionals within the organisation. [IG03] We need strategic partnerships with certain data and analytics vendors.[IG01] We need kind of a way to educate the organisation, to just embrace this capability.[IG02] And we need to have the right incentives in place to be able to embrace this kind of pioneering mind-set, which can… Often you run into this innovator's dilemma. [IG06]*

Alternatively, project members tended to focus on controlling environment including defining the main requirements of initiatives and its operational reliability. For example the Vice-President, Global Planning and Tech Ops, IT GOS Admin expressed the view:

*Our customers are going to get smarter than us, and our competitors are going to get smarter than us. So how do we try to get ahead of the game? And that's where the concept of creating something around Big Data was born and then as we brought Deloitte on board to help us really strategize and figure it out, that's how we moved into building and identifying capabilities.* ***IG06***

(As was mentioned earlier, the company engaged with the Deloitte consultancy to support the new initiatives.)

Regarding the above point, the Executive Director also recalled:

> *It was kind of strategy maybe meets operations, is that you're executing…If you had this Big Data capability, what would you use it for? What kinds of things would you like to do with it? It might not even be realistic, but what things come to mind that we could do differently that we could fuel? What value would it have, or impact might it have for us? And do you know the data? Like is the data available? And is the analytics available today?* ***IG01***

Once the threats and opportunities from the Big Data asset (section 5.2.2) were carefully elucidated during the preparation phase, the response strategy was adopted accordingly in the building phase. As the Director of Knowledge Utilization outlined:

> *We've put some of the partnerships in place to start getting access to the data, and some of the skill sets, data science, alliance management, and all this kind of thing. So that's what we've been focusing on the last 12 months, really get the basis in place, so we can actually start leveraging these types of data beyond the research area.* ***IG02***

The overall strategic competitive response, referring to the ability of the company to understand and adapt to environmental trends (Protogerou et al., 2011), was acknowledged as one of the key strengths of the company. This ability incorporated timely responses to competitive strategic moves, the systematic formulation of long-term strategy, and the flexible adaptation of competitive changes, as related by the Executive Director of IKU:

> *A senior leadership team that identified this as a priority, and I think without that it would be very difficult to do anything, purely because there's so many competing priorities within the organisation. In order to create a transformative capability, you*

*need the most senior-level people saying okay, I know we have a lot of things going on, but this is one thing that I want you to make sure that you try to embrace, and you try to see the applications of this within our organisation. So those are the things I think would be our strengths.* ***IG01***

As suggested in the literature (Teece, 2007; Protogerou et al., 2010) an effective strategic response to a new environment must be followed by an appropriate change in the internal reconfiguration of an organisation, as the new business environment may demand a completely different scientific and technological foundation, and often a different mind-set, and marketing systems (Johannesson and Palona, 2010). While recognising opportunities at the strategic level, and the importance of increasing awareness regarding identified opportunities, both played an important role, so did the company's cultural transformation. The company's reconfiguration ability, particularly in terms of networking and partnership, also had important roles to play in defining and building required capabilities for Big Data within the company.

The company's strategic competitive response capabilities are summarised in the table 5.3 below.

| **Definition (Strategic Competitive Response Capabilities) Examples in the literature (Authors)** | **Dynamic Capability** | **Appearance in the Case Study** | **Direct quotes (comments) from Interviews and Secondary Data Comment** |
|---|---|---|---|
| Strategic competitive response capability is the firm's as the ability to sense/scan the environment, identify new opportunities, assess its competitive position, and respond to competitive strategic moves. (Teece, 2009, p.200; Protogerou et al., 2010). | Sensing (and shaping) new opportunities are very much a scanning, creation, learning, and interpretation activity (Teece, 2009). | The IKU project was the result of a lot of hallway conversations between very senior leadership, to make sense of what the Big Data environment meant for the company | *A lot of noise going on about you know Big Data and you know we have a sense of what it is but not really a good sense of what it means for us. What we should do about it, if anything. And then they assembled a very small team, and really what our task was, was to figure out this world of Big Data and tell us what we need to do about it.* ***IG01.*** |
| | Seizing refers to the organisational strategy and infrastructure for making appropriate decisions and absorbing and integrating resources to create and capture value from opportunities (Teece, 2009). | Lots of discovery, strategic thinking, and proactive strategic conversations regarding Big Data before the project started | *So we did a little bit of diligence. And that diligence resulted in over you know it was 150 use cases across the organisation. So we had a good idea that there was a lot,that it seemed like our teams thought that we could do with this. That this was something that could fuel a lot of different areas.* ***IG02*** |
| | Respond to competitive strategic moves. Maintain competitiveness through enhancing, combining and | Strategies tended to focus on predicting the environment, positioning the project | *We need the right skillsets, like the data scientists, like the data wranglers, the taxonomists, the Big Data IT professionals within* |

| | | | |
|---|---|---|---|
| | reconfiguring (when necessary) an organisation's existing and new resources and capabilities. (Teece, 2009). | planning, and establishing the effects of initiatives. This resulted in identifying needs and activities to proceed the project further | *the organisation.**[IG03]** We need strategic partnerships with certain data and analytics vendors.**[IG01]** We need kind of a way to educate the organisation, to just embrace this capability.**[IG02]** And we need to have the right incentives in place to be able to embrace this kind of pioneering mindset, which can… Often you run into this innovator's dilemma.**[IG06]*** |

*Table 5.3: Strategic Competitive Response (CF.3.2.1) (Author's own)*

#### 5.2.4.2 Reconfiguration (DC) (CF.3.2.3)

The empirical investigation suggested that, in terms of IT technology, some of the company's marketing and connectivity capabilities were enhanced as a result of its reconfiguration ability. For example, through networking and partnership, the company was able to identify different internal work streams, resources, and capabilities that had to be reengineered within the organisation in order to fully leverage Big Data. One of the company documents indicated:

> *Through our Network of Strategic Partners, the company is cultivating a community of new expertise – both centrally and embedded in the business, where data scientists, digital experts, data stewards, taxonomy experts, epidemiologists, and business development/alliance managers will cultivate and help build new skillsets to embrace our expanding data, advanced analytics, and technology capabilities. These new skillsets and expertise enable us to realize the value of data across the organization and help increase the entire organization's acumen around data and analytics.* ***DO01***

An interesting insight from the data suggested that the Big Data environment was evolving and defining itself. There were not many cutting-edge directions, and to successfully innovate the development of internal capabilities it was important to collaborate and form partnerships with experienced data management experts. Furthermore, as the Vice-President of the project explained, engaging in networking and establishing partnerships not only accelerate access to the skill-sets required to develop new capabilities, but also facilitate in-house learning, which enables immediate value delivery. For example, the Vice President of the project believed that setting up a 'Two-in-a-Box' structure with partners was an effective choice as this approach allowed the company to obtain access to and also learn required skills.

> *Because certain skills that we didn't have access to, we set up a Two-in-a-Box, one to accelerate the access to the skill sets, so we don't have to wait delivering a use case, because on day one you have access to it. But in parallel, because of the Two-in-a-Box structure, you accelerate the learning.* ***IG05***

Moreover, he added that the most important way in which this approach was effective was that it enabled the company to access the knowledge required to proceed with such initiatives.

> *You get the knowledge in-house, so you can immediately start delivering value, and you team it up with the internal process, so actually both parts become multi-factor. One is learning, around the new skill set, but they come with the knowledge of the company. The other one has the skill set, the technical skills for example, but they don't know how the company works, so you put them together and they complement each other*. ***IG05***

A good example of the company's ability to use networking and partnership to build new Big Data capabilities was their new digital platform, a cloud-based data environment which enables connectivity of different functions and scales up as required for analytical needs. Collaboration with organisations that possess expertise in Big Data and technology also complemented the company’s ability to identify the different internal work streams, resources, and capabilities that have been re-engineered within the company to fully leverage Big Data. As the Vice-President of the project explained:

> *When we started, we had zero capabilities. Some of the data science capability was sitting in the research shelf where it naturally sits, or it starts. When we started at an enterprise level, it was by design, it's in collaboration with IT but it's not in IT, which*

*I think is a differentiating factor. We, by design, did a very broad and deep engagement with an expert in this field to help us accelerate building the capability, and there was both the technical side, but also some of the data science.* ***IG05***

On the same topic, the Executive Director of Data Governance explained that building capabilities through partnership helped the company to more quickly and cheaply respond to the changes required by Big Data. As he highlighted:

*We have built what we need to do this right now, but we have built it a lot through partnership too. Like we have not hired in all of these skillsets, because to be honest we believe that in order to do that and to find the right people, it is costly, will take time, and a significant amount of time.* ***IG01***

Another interesting insight from the interview data was that in addition to benefiting from partnerships and external expertise, it is important for a company to develop its own in- house capabilities. It is important to effectively communicate changes and innovations internally to increase awareness of such efforts, which helps to promote learning and best practice.

The company's reconfiguration capabilities are summarised in the table 5. 4 below.

| **Definition (Reconfiguration Capabilities) Examples in the literature (Authors)** | **Dynamic Capabilities** | **Appearance in The Case Study** | **Direct Quotes (comments) from Interviews and Secondary Data Comment** |
|---|---|---|---|
| Reconfiguration (Box. 3.2.3) is an organisation's ability to extend and modify existing capabilities in response to changes introduced in the market and technologies that are generated through new knowledge based on Big Data (Teece, 2007; Kwon, et al., 2014). | Ability to identify different internal work streams, resources, and capabilities that had to be re-engineered within organisation.<br><br>Collaboration and partnership with leaders in this space | Collaboration and partnership with leaders in this space<br><br>Setting up a Two-in-a-Box structure with partners.<br><br>The company's new digital platform, a cloud-based data environment, which enables connectivity of different functions and scales up as required for analytical needs | *These new skill-sets and expertise enable us to realize the value of data across the organization and help increase the entire organization's acumen around data and analytics.* ***ID01***<br>*Because certain skills that we didn't have access to, we set up a Two-in-a-Box, one to accelerate the access to the skill sets, so we don't have to wait delivering a use case, because on day one you have access to it. But in parallel, because of the Two-in-a-Box structure, you accelerate the learning.* ***IG05***<br>*We, by design, did a very broad and deep engagement with an expert in this field to help us accelerate building the capability, and there was both the technical side, but also some of the data science.* ***IG05*** |

*Table 5.4: Reconfiguration (CF. 4.3) (Author's own)*

### *5.2.4.3 Learning Capabilities (DC) (CF. 3.2.2)*

Organisational capabilities are suggested to be able to evolve through learning (Teece et al., 1997; Eisenhardt and Martin, 2000; Zollo and Winter, 2002; Helfast and Peteraf, 2003). On the other hand, introducing innovation such as new resources and technology involves promoting and shaping the learning process. In the case study company, a 'trial and error' learning process fostering the development of capabilities emerged from the Big Data project. By facing a new situation and difficult problems the company engaged in learning. Before finally achieving success, the case study company experienced a learning process that took it from knowing very little to understanding how Big Data could benefit the organisation. Despite the challenge this represented it was acknowledged that learning is a very important process, which through experimentation and repetition leads to better and quicker resolution of specific problems and at the same time enabling firms to identify new opportunities (Teece et al., 1997).

The project members were fully committed to a long learning journey. As the Executive Director of the project recalled:

> *When I came on this team, I had never worked in Big Data before, you know I am marketing person I've led market access teams, I've led product development teams, but this whole area been new to me. And I think that's the case for most people that are on the team, and is somewhat good in that we're able to keep a business framework or mind-set, but you have to come up the learning curve quite a bit on the technology and on the data, and just what this space is.* ***IG01***

The project members made continuous efforts to remain engaged with the learning process. For example, participants spoke about their positive experience of immersion in the new world of Big Data, and of learning through trial and error. They believed that full exposure and a 'hands-on' approach enhance experience and knowledge, leading to better understanding of the benefits and impact of the innovation. Furthermore, by constantly setting new tasks and objectives, project members presumed that they were experiencing incremental learning throughout the process.

As part of the *immersion/experience practice* the company introduced globally, at different phases, several immersive activities. The aim of this was to expose and demonstrate different ways of how the Big Data ecosystem was evolving and what this would mean to the people within the company. Different techniques, such as 3D videos, virtual reality, and use cases were used to help people within the company to visualise Big Data opportunities. (A use case is a methodology used in system analysis to identify, clarify, and organise system requirements). Participants believed that these activities were particularly helpful in increasing awareness during the planning phase of the opportunity presented by Big Data. As the Director of Knowledge Utilisation put it when explaining the goal of such practices:

> *"So, that it's almost imagine If"…experience. And we've used 3D videos, virtual reality, our deep-dive use cases networks, so we've done a couple of those globally. This helped us extend the team, which is all the likeminded people at the company that have an interest in this capability.* ***IG02***

Furthermore, as part of this practice, a large-scale event called *The Immersion Experience* was organised by the project members at the building phase, after the new cloud-based platform was put in place. (The building phase had completed before the interviews were conducted for this study).

> *So we wanted to immerse people in the company in what Big Data can do for them. Specifically for the company, and for pharma industry, right? So that was a big event planned in K Building, where about 400, 500 people showed up. And they would go through the various booths just to get immersed into, like, hey here is the art of the possible. And this is what we are trying to do with this platform, right. And show them some of the insights we have generated from the platform in the process.* ***IG02***

This provision of updates via immersion events, or real-time updates using dashboards and so demonstrating the value of previous tasks enabled project members to monitor how the project was progressing. Moreover, participants believed that taking this approach had helped them to achieve the desired result.

Other positive effects were also recognised in the project as being the result of learning from the use of systematic analysis in the search for new solutions, meaning that such efforts tended to be self-reinforcing. This was a gradual process that led to new discoveries which helped widen the scope of the project members' thinking. One of the participants shared her experience:

> *We started to realise in our two-plus year journey of this it's a gradual process. You know we started in one area and then people get excited and you start to expand and go in a different direction, but focus on some core activities and then start to replicate that for other types of similar questions. And reuse that analyses perhaps to answer other questions in other business areas.* ***IG01***

Teece (2007) suggests that analytical systems and techniques such as scenario planning or joint decision-making can help overcome cognitive limitations and framing biases in learning which lead to local adaptation. An instance of this theory being observed in practice was that of the Business Council, which is the company's active communication team and a good example of the company's in-house joint decision-making practice. For example, the Vice-President explained that:

> *As we build the platform, that's run by leaders that have been nominated from across our business. The Business Council and active communications team, make sure that the whole company just knows it. So we're not making any decisions in the absence of a business person saying that that would provide value to that part of the organisation.* ***IG05***

Another good example of joint decision-making being used to facilitate learning was the company's *App Vision Steering Committee*, which was made up of senior-level people from across the organisation.

More evidence of the company's efforts to make the learning process more effective could be seen in its initiative to set up a community of practice. Regular community of practice meetings helped the company to create a sense of community, and also helped to ensure that the process they were engaged in was reliable. Participants explained that the community of practice session made up part of the company's training, although it was mostly presented and coordinated around a use case or data set. Use case analysis helped project members think ahead, and critical analysis helped them think more broadly, helping to recognise when new skills or strategies were needed. Moreover, there was a common belief that regular discussion centred on analysing mistakes and successes alike helped prevent other errors and led to improved learning by project members. The Vice-President spoke of the degree to which this practice was helpful:

> *Especially in the data science area, and also in the digital, we've it (Regular community of practice meetings). So, they meet at least monthly, where either the data science community goes to, well we just got Truven in, so Truven does a learning session about what is a data set. Or they just did a use case, they shared a use case with the community of practice. We learn as we go. At least right now this year on our tools, and then next year on other tools, other things that are more industry-focused.* ***IG05***

Further findings indicate that applying leadership skills from different parts of the business, in combination with new learning, enables the identification of capabilities that would be relevant to each function for the next stage. As an example one of the participants explained:

*Different managers give us feedback on what disease areas do we focus on, what should these apps look like, what should they do, what functionality do they need, etc.? They also nominate people to actually work on the working group, to actually build it, with our team. So like on the apps, that's just one example. We do it with the teams and then we provide updates to virtually every single leadership team at as well as at the most senior level to the CEO and we do a lot of communication on our website, etc.* ***IG06***

However, it must be acknowledged that even though there were positive implications for the ability to identify and develop capabilities through the learning processes mentioned above, most of the informants were also clear that in order to speed up some processes it was necessary to invest in the development of new skills.

The company's learning capabilities are summarised in the table 5.5 below.

| **Definition (Learning Capabilities) Examples in the literature (Authors)** | **Dynamic Capability** | **Appearance in the Case Study** | **Direct quotes (comments) from Interviews and Secondary Data Comment** |
|---|---|---|---|
| Learning (Box. 3.2.2 CF) is defined as 'the capacity or process within an organisation to improve or maintain performance based on experience accumulation, knowledge articulation and knowledge codification (Nevis et al., 1995, p 73, Zollo and Winter,2002). | Experience accumulation refers to the central learning process by which operating routines have traditionally been thought to develop. Incremental improvements can be accomplished through the tacit accumulation of experience and acts of creativity (Zollo and Winter, 2002) | Continuous efforts to remain engagement with the learning process<br><br>Experience of immersion in the new world of Big Data and learning through trial and error<br><br>Setting constantly new tasks and objectives<br><br>The immersion/experience practice<br><br>At different phases the company introduced several immersive activities globally | *So, that it's almost imagine If"…experience.. And we've used 3D videos, virtual reality, our deep-dive use cases networks, so we've done a couple of those globally. This helped us extend the team, which is all the likeminded people at the company that have an interest in this capability.* ***IG02***<br><br>*So we wanted to immerse people in the company in what Big Data can do for them. Specifically for the company, and for pharma industry, right? So that was a big event planned in K Building, where about 400, 500 people showed up. And they would go through the various booths just to get immersed into, like, hey here is the art of the possible. And this is what we are trying to do with this platform, right. And show them some of the insights we have generated from the platform in the process.* ***IG02*** |
| | Knowledge articulation The process through which implicit knowledge is articulated through collective discussions, de-briefing sessions and performance evaluation processes. By sharing | Providing updates with the immersion events<br><br>Real-time updates through dashboards<br><br>Demonstrating the value of previous tasks | *As we build the platform, that's run by leaders that have been nominated from across our business. The Business Council and active communications team, make sure that the whole cell just knows it. So we're not making any decisions in the absence of a business person saying that that would provide* |

| | | | |
|---|---|---|---|
| | their individual experiences and comparing their opinions with those of their colleagues, organisation members can achieve an improved level of understanding of the causal mechanisms between the actions required to execute a certain task and the resulting performance outcomes (Zollo and Winter, 2002) | The Business Council and active communications team<br><br>The App Vision Steering Committee that company had for the senior-level people from across the organisation<br><br>Regular community of practice meetings to create a community sense, and also to ensure that process reliable<br><br>Use case analysis<br><br>Regular discussion and analysis of mistakes and successes | *value to that part of the organisation.* ***IG05***<br>*Especially in the data science area, and also in the digital, we've it. So, they meet at least monthly, where either the data science community goes to, well we just got Truven in, so Truven does a learning session about what is a data set. Or they just did a use case, they shared a use case with the community of practice. We learn as we go. At least right now this year on our tools, and then next year on other tools, other things that are more industry-focused.* ***IG05*** |
| | Knowledge codification Knowledge codification is a step beyond knowledge articulation. It aims uncovering the linkages between actions and performance outcomes most of them are intended simply to provide guidelines for the execution of future tasks | Systematic analysis and search for new solutions<br><br>Risk assessment management<br><br>Focus on some core activities and then start to replicate that for other types of similar questions | *As we build the platform, that's run by leaders that have been nominated from across our business. The Business Council and active communications team, make sure that the whole company just knows it. So we're not making any decisions in the absence of a business person saying that that would provide value to that part of the organisation.* ***IG05*** |
| | Managers should be open-minded to new ideas | Anticipated the need to leverage Big Data initiatives alongside internal competing priorities | |

*Table 5.5: Learning (CF 3.2.2.) (Author's own)*

#### 5.2.4.4 Coordination (CF. 3.2.4)

Although the Big Data project seemed to be progressing well, project members had some concerns regarding how this innovation would be coordinated across different functions (Marketing, IT, policy) and franchises (different countries - EMEA). The implementation of new configurations of operational capabilities requires the effective coordination of a variety of tasks and resources and the synchronisation of different activities (Collis, 1994; Helfat and Peteraf, 2003). Thus, participants pointed out that there was a need for additional resources to be embedded in each function, together with advanced analytics skill-sets.

> *Data scientists are in high demand. We need to embed individuals with those specialised skills in functions from R&D to supply chain and commercial. In different functions you have some gaps and we need to bring in capacity and capabilities in house so not to be over dependent on external partners.* ***IG06***

Even though efforts had been made to coordinate in the process of innovation, and although this effort had been assisted by the deployment of the connectivity platform, successful coordination between different functions and franchises was an ongoing obstacle at the time of the interviews. However, to ensure that silos did not remain obstacles, the project members were providing regular (e.g., weekly, monthly) cross-organisational updates to different management teams. This was highlighted as a valuable way of ensuring that progress was made on an ongoing basis. The coordination capabilities found within the company are summarised below:

| **Definition (Coordination Capabilities) Examples in the literature (Authors)** | **Dynamic Capability** | **Appearance in the Case Study** | **Direct quotes (comments) from Interviews and Secondary Data Comment** |
|---|---|---|---|
| Coordination (Box. 3.2.4) Capabilities/processes connect and interface single activities through communication, scheduling, task assignment, collaboration and other related activities. This is an important capability to deal with the changing business environment especially in Big Data case when there are fewer experiences and less good practice implications. Protogerou et al., (2011) | Ability to connect and interface single activities through communication<br><br>Scheduling, task assignment | Effectively communicate the change internally and increase awareness of the ongoing efforts, in order to promote learning and best practice<br><br>The additional resources to be embedded in each function together with advanced skill-sets around analytics | *Data scientists are in high demand. We need to embed individuals with those specialised skills in functions from R&D to supply chain and commercial. In different functions you have some gaps and we need to bring in capacity and capabilities in house so not to be over dependent on external partners.* ***IG06*** |

*Table 5.6: Coordination Capabilities (CF. 3.2.4) (Author's own)*

### *5.2.5 Changed Capabilities in Response to New Opportunities (CF. 4)*

As a result of the ongoing learning efforts, the reconfiguration ability, and the improving ability to coordinate, the company was able to develop new capabilities. As an example, one of the milestones was the establishment of Big Data catalogue, followed by the Big Data connectivity platform, *Synapse*. As the Vice president explained:

> *Synapse is the connective technology at the heart of our efforts to remove cross-functional and cross-therapeutic silos by connecting data assets, analytical tools, and expertise across the company. Synapse is the company's Big Data platform with tools to search, access, and analyse data collaboratively to generate insights for the*

*business in more efficient ways and using newer methodologies that allow us to calculate and triangulate data like never before.* ***IG05***

Discussing the new platform and its ability, the IT and data governance director explained more in dilates that *Synapse* enabled the company to quickly search through a catalogue of data sets in a way that would have previously taken days and in many cases even weeks to accomplish.

*Synapse Explorer enables you to search through a catalogue of data sets, studies that generated those data sets, and the strategic partners we have. Applications on Synapse Analyzer allow you to easily assess feasibility of that data in seconds – where in the past this could have taken weeks. The high-compute environment with Synapse Analyzer gives you the ability to connect and analyze large, disparate data sets with advanced analytical tools* ***IG03***.

As has been outlined several times in this report, the company's initial focus on Big Data was to arrive at a 360-degree patient view. This kind of holistic patient profile included information about patients' tasks, treatment timelines, progress, and future appointments to help the company understand how their drug was performing against their competitors' drugs, or how the company could prove to insurers that their drug was more effective than that of their competitors. The project members believed that introduction of the *Synapse* platform enabled the company to achieve some of those objectives:

*You know, the Big Data platform enabled us to do that. We were typically outsourcing those things. Right? And we would get a PowerPoint. But then you lose the iterative sort of natures. And your way, it answered this question, but can it answer now this? And we didn't have any ability to do that. Like, it would take months. So we gave them that ability at the tip of their fingers.* ***IG05***

Talking about new enhanced capabilities, the Executive Director of the project, for example, gave some indication about what they had achieved from the marketing perspective since the connectivity platform went live:

> *Now it is starting to expand into other areas. So commercial, getting sales, and marketing insights. Like how effective is my marketing campaign? You know, why do I see a dip in the drug sale in a particular month? What's the reason for that? We were unable to do so… Or can I predict that I'm going to see a dip in the drug because of certain market forces? So those are the kinds of analysis we are able to do, or contemplate now, that we were not able to do before* ***IG01***

These were only the first steps of the operation phase, but it was already being proven that the preparation and building phases had been well-executed.

Data harmonisation was another key foundation that enabled the company to connect and protect their data by establishing essential company-wide policies and processes, such as data governance and enterprise standards in accordance with the new platform. Participants believed that:

> *The success of embedding a new capability in the organisation is dependant on how we as an organisation are open to working and pioneering new ways. As we move from building the foundation to enabling the business to learn about these new capabilities and collaborate. I mean we have delivered on the strategy too, right? So we have the platform, it's up and running. We have people using it.* ***IG05***

The company's changed or new capabilities in response to new opportunities are summarised in the table 5.7 below.

| Enhanced or New Capabilities | Marketing and IT Capabilities | Direct quotes (comments) from Interviews and secondary data Comment |
|---|---|---|
| A service catalogue | Ability to reduce the data duplication and cost | *Synapse is the connective technology at the heart of our efforts to remove cross-functional and cross-therapeutic silos by connecting data assets, analytical tools, and expertise across the company* ***IG05*** |
| Big Data connectivity platform, Synapse. | Ability to connect different operations and functions | |
| A cloud based environment | Ability to more quickly search through catalogues of data sets. | *The high-compute environment with Synapse Analyzer gives you the ability to connect and analyze large, disparate data sets with advanced analytical tools* ***IG03.*** |
| Data harmonization | Ability to deliver data-driven decisions. | |
| | Ability to get 360 degree patient view. | |

*Table 5.7: changed or new capabilities in response to new opportunities (CF. 4)*

The findings presented in this section have been organised in line with the conceptual framework of this study. Figure 5.2 describes the key aspects of the findings from the Global site.

As presented in the model (Fig 5.2), the findings suggest that in the case study company, in response to changes in digital environment for the adoption of Big Data initiative, processes such as sensing, seizing, learning, and coordination all had a positive impact on the reconfiguration of the company's operational (IT and Marketing) capabilities. Furthermore, managerial and organisational processes such as: strategic competitive response, learning, reconfiguration, and coordination guided the overall Big Data innovation process in the company. Together they played a major role in identifying, moderating/enhancing, or developing new capabilities at every stage of the Big Data project.

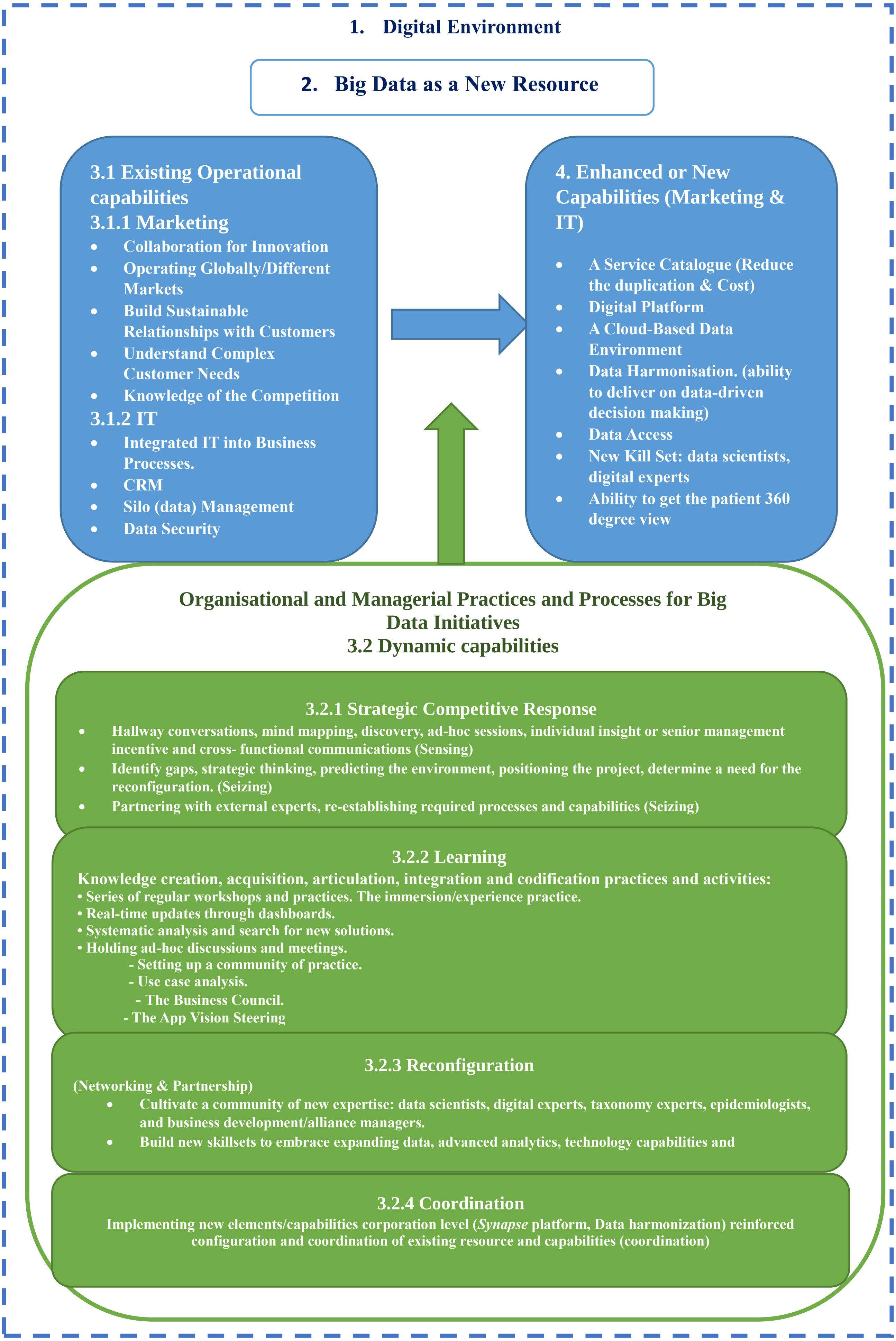

1. Digital Environment
2. Big Data as a New Resource
3.1 Existing Operational capabilities
3.1.1 Marketing
• Collaboration for Innovation
• Operating Globally/Different Markets
• Build Sustainable Relationships with Customers
• Understand Complex Customer Needs
• Knowledge of the Competition
3.1.2 IT
• Integrated IT into Business Processes.
• CRM
• Silo (data) Management
• Data Security
4. Enhanced or New Capabilities (Marketing & IT)
• A Service Catalogue (Reduce the duplication & Cost)
• Digital Platform
• A Cloud-Based Data Environment
• Data Harmonisation. (ability to deliver on data-driven decision making)
• Data Access
• New Kill Set: data scientists, digital experts
• Ability to get the patient 360 degree view
Organisational and Managerial Practices and Processes for Big Data Initiatives
3.2 Dynamic capabilities
3.2.1 Strategic Competitive Response
• Hallway conversations, mind mapping, discovery, ad-hoc sessions, individual insight or senior management incentive and cross- functional communications (Sensing)
• Identify gaps, strategic thinking, predicting the environment, positioning the project, determine a need for the reconfiguration. (Seizing)
• Partnering with external experts, re-establishing required processes and capabilities (Seizing)
3.2.2 Learning
Knowledge creation, acquisition, articulation, integration and codification practices and activities:
• Series of regular workshops and practices. The immersion/experience practice.
• Real-time updates through dashboards.
• Systematic analysis and search for new solutions.
• Holding ad-hoc discussions and meetings.
- Setting up a community of practice.
- Use case analysis.
- The Business Council.
- The App Vision Steering
3.2.3 Reconfiguration
(Networking & Partnership)
• Cultivate a community of new expertise: data scientists, digital experts, taxonomy experts, epidemiologists, and business development/alliance managers.
• Build new skillsets to embrace expanding data, advanced analytics, technology capabilities and
3.2.4 Coordination
Implementing new elements/capabilities corporation level (Synapse platform, Data harmonization) reinforced configuration and coordination of existing resource and capabilities (coordination)

*Figure 5.2: The Key Aspects of the Findings from The Global Site (Author's own. Developed based on the CF and on the findings of this study)*

### *5.2.6 Summary of Global Findings*

While the digital environment served as an enabler for the Big Data initiative, the company’s internal competencies and capabilities (IT, Marketing) (Fig. 5.2, section 3.1) had a major influence in successfully progressing the project (DO01; DO03; IG01; IG04; IG07).

However, it was also found that the nature of Big Data required reconfiguration and further development of such capabilities. The data indicated that the preparation process for Big Data initiatives in the case study company was triggered by sensing (IG01; IG06; IG02) the opportunities, followed by the development of a first initial idea to seize (IG01; IG02; IG03; IG05; IG06) the opportunity to adopt and implement this idea.

Drawing on their dynamic capabilities (Fig. 5.2, section 3.2) for sensing Big Data opportunities with a creative approach (mind mapping, discovery, hands-on experience, *ad hoc* sessions, individual insight, or senior management incentive and cross-functional communications) the company was able to identify capabilities gaps (silo approach, connectivity, data management skills) and determine a need for the reconfiguration of existing resources and capabilities.

For example, the ability to capture and recognise the gaps mentioned above requires a stream-lined data management approach, and the biggest issue (highlighted by the participants) was the company’s silo approach of data management, which was not compatible with the new initiatives (IG02; IG05; IG06). An ability to coordinate different functions and franchises (Marketing, IT, policy, different countries) was also necessary for progress to made in Big Data initiatives.

Development of the initial idea to seize the opportunity (identifying gaps, strategic thinking, predicting the environment, positioning the project, determining a need for reconfiguration) was largely influenced by engagement with the expertise in the field at the case study company.

It was evident (IG01; IG02; IG07; IG08) that the interaction between multiple factors such as partnership, government promotions, and networking enabled the company to seize the opportunity and to gain new knowledge about Big Data initiatives. This led to the development of new capabilities which helped to fill the existing gaps.

The implementation of new capabilities (Fig. 5.2, section 4) such as the cloud-based environment, the data service catalogue, and the *Synapse* platform was followed by the introduction of new elements such as a stream-lined data management approach, and improved coordination. This was accompanied by the reconfiguration of the company's existing marketing and IT capabilities.

The new data connectivity platform *Synapse* and the cloud-based digital environment had a significant operational impact, such as: the reduction of the silo approach of moving and processing data (data management), improved storage ability, improved data accountability, and data harmonisation (data governance). A service catalogue reduced the duplication of data, which consequently reduced the cost of acquiring and managing data. Thus, building these foundational capabilities allowed incremental operational efficiencies. Most importantly, the company was able to get a 360-degree view of customers, which helped improve customer relationships. These new capabilities enabled the company to realise the value of data across the organisation and helped increase the entire organisation's acumen concerning data and analytics.

It was also evident (IG01; IG02; IG05; IG06) that specific learning activities/practices (Fig. 5.2, section 3.2.2) triggered capabilities development and guided the overall Big Data adaption process at the case study company.

This model will now be used to assess the findings from the EMEA site, which are presented in the next section.

## 5.3 EMEA Findings

### *5.3.1 Introduction*

As discussed in the previous sections, there is empirical evidence that Big Data initiatives (the IKU/Big Data project) brought a transformative change to the Global (mainly US) site of the case study company, where the project was originally planned and implemented.

Analysis of the data from the company's EMEA site indicates that although the project had not progressed as far as at the Global site, the Big Data preparation phase was nonetheless very similar between the two. However, as the project at the EMEA location started after the *Synapse* platform had already been adopted by the Global site, this gave workers at the EMEA site the opportunity to not only explore (sense and seize) the Big Data opportunities but also to spread knowledge about the *Synapse* platform. This means that knowledge integration and learning processes both played an important role during the Big Data preparation process in the EMEA site.

The EMEA project was led by a group of people from different departments and different countries, named *The Champions,* who would in a sense help to 'evangelise' what the Global site had already achieved. Geographical factors meant that some of the participants had only been peripherally involved in the Global project, while most others had not been involved at all.

Participants from the EMEA site believed that deployment of the project in EMEA meant that certain changes and extensions to *Synapse* would be needed, as well as an understanding of how to efficiently support this platform. The objectives of the EMEA project were to gain insights from the Global project about Big Data initiatives and make the *Synapse* platform visible to different functions. Another important step was to clearly and effectively communicate the objectives that the project members were hoping to achieve. This entailed the need to convince each of the country's authorities (i.e. the company's franchises) to accommodate new processes that would ensure full usage of the *Synapse* platform.

Analysis of the data indicates that the success of this transformation and the building of new capabilities relied on the company's existing skills in knowledge integration, learning, reconfiguration, and coordination. These practices were delivered by experienced project members, although national boundary factors, regulations, and data policy governance presented a greater challenge to the implementation of Big Data initiatives at the EMEA site than in the Global.

The remainder of this chapter presents findings from the EMEA site that are organised under the concepts from this study's theoretical framework (as with the Global site findings), followed by discussion of the main similarities and differences between these two parts of the case study company in regards to the Big Data adoption process.

### *5.3.2 Digital Environment (CF.1)*

The new digital environment had the same influence on the adoption of Big Data initiatives and capabilities development in EMEA as in the Global site of the company. However, in Europe, data tends to be more commercialised due to different data governance laws and ownership. This results in limited access to data, or extremely high data costs. Consequently, pressure on healthcare organisations regarding data access is higher in Europe (Deloitte, 2015). Although some open modes of data access and sharing are emerging in which data are made publicly available to organisations to stimulate innovation and provide transparency (Van den Broek and Van Veenstra, 2015) a major barrier in Europe is the higher degree of data privacy. The company's EMEA leaders believed that the evolving digitalised world that can be leveraged in the healthcare sector is having a positive impact on and influencing data privacy laws in terms of recognising the need for exploring and embracing this potential.

This new approach was extremely important for the Germany's franchise leader. It will continue to be very difficult, particularly in Germany, to obtain even critical patient data from customers and vendors without changes being made to regulations and data privacy laws. However, participants believed that the company was able to start using the existing CRM data to test the new platform. It was also believed that using and sharing all the raw data that the company owned - the customer data, and sales data from the local service providers - could be used to answer business questions, speeding up the time between the basic research stage to the market.

Furthermore, project members believed that on top of the regulations and privacy laws, which are more apparent in Europe than in the US, there is also *social* pressure (e.g. peer pressure, academic pressure, socio-economic pressure) in gerent in the system. The digital changes that are happening in the world, and the transformational impact that sharing personal data has to a patient's life, are incrementally forcing changes such as data sharing to become the norm.

A prominent example of this was offered by the project's director when he explained how sharing data and using advanced technology can, in some countries, allow a patient who has a particular illness and a specific genetic make-up, for example, to search for and find patients with similar circumstances in order to communicate, share, and understand more about available drugs and treatments. This ability would also allow patients to monitor which drugs or regimes have or have not worked in order to inform their own decision-making. Such a system would be a valuable one for pharmaceutical companies to aspire to, and the participants believed it to be not only feasible but actually already being practiced in various parts of the word. However, a major barrier in Europe is the lack of data-sharing, and the result of this is increased social pressures in the system. The impact of social pressure on the system is one of the dynamics that allows examination of the political and social environment in which companies operate (Shao, 2009). On the positive side, they also believed that such pressures will influence the changing of data privacy laws. Participants believed that:

> *It is inevitably going to change, right, for multiple reasons, but it's mainly the digital world that we are all living in.* ***IE10***

Recognition at management level of the influence from the external macro-environment (political, social, technological), as well as the external micro-environment (customers, competitors, distribution channels) fuelled the spirit of innovation that was at the heart of the development of Big Data initiatives at the EMEA site. As one of the company's senior leaders remarked:

> *It's just the economic pressure in the system to force change. Yet Big Data also requires a great deal of change. We have to rethink how we access and distribute information, how we interact and coordinate with different departments and data holders and that the evolving digitalised world. That can be leveraged in the healthcare sector will have a positive impact on sort of releasing that economic pressure in the system.* ***IE09***

The pressures mentioned above, as well as patients and payers who are key to the success of products and so help determine their price, were stressing global leaders to react more quickly than ever before to transform their businesses to compete in the new business environment, to react to the market, and to match the speed of technological changes. The Executive Director, Information Knowledge Utilization shared his view as below:

> *Our world is changing. Look at the Uber, the Amazon, the company… the Airbnb. So our world is changing, not only our world is changing, our industry is changing. How is it changing? Digitalisations, democratisation of data, differentiation of data you know.* ***IE09***

### *5.3.3 Resources (CF.2)*

#### *5.3.3.1 Big Data as a New Resource (opportunities and challenges) (CF. 2.1)*

- ***Big Data Opportunities***

As with the Global findings, it is clear from the EMEA data that the perception and understanding of the benefits of Big Data were critical determinants of the Big Data initiatives implementation process.

Participants believed that, in an evolving digitalised world, the company could benefit from Big Data in regards to understanding patients and offering them more personalised treatments. Consequently, they saw this as a step towards the personalised medicines offered by Big Data perspectives and technological advancements. For example, one of the managers expressed his expectation as below:

> *We've been discovering, developing drugs, commercialising drugs, pretty much the same way for multiple decades, right? What we're talking about now, in the light of Big Data, and technological advancements, I'll just draw those parallels again to the like a Uber, transforming the way we travel basically, that's the sort of transformational change we're talking about that is going to happen in our healthcare environment, and in our business.* ***IE01***

The opportunities offered by Big Data were also associated with operational effectiveness. For example, better connection/coordination of different sources of data, including public data, data licensed from outside parties, and the company's own internal research, pre-clinical research, or clinical research data. There was a common belief that coordination of different sources of data would offer better insights and outcomes in serving patients. As the Director of Clinical Trials explained:

> *Big Data is critical for us. for example, let's say you take like a thousand-patient sample, and you do something with those thousand patients, and then based on information you collect, you deduce what will happen to the entire population. So the bigger your sample is, the more accurate and reliable your results are. You see? So introducing Big Data here, actually helps you to produce better results.* ***IE02***

Respondents also highlighted that the most important objective they were looking to achieve through Big Data initiatives was to improve their service to patients by improving and extending customer relationships, generating new business opportunities, and speeding up and cheapening the research-to-market process. In line with this point, the Senior Director of the company's Italian franchise commented:

> *Whatever we can do to help the patients to have access to our product is good for us. It means that we can speed up the approval of the drug, we can speed up the reimbursement of the drug, but we can also speed up the evolution of the drug. We can also speed up the knowledge and the acceptance for the treatment by the patient.* ***IE07***

Alongside these recognised opportunities, participants also acknowledged that Big Data opportunities should be communicated clearly at each stakeholder level, and that objectives should transparent and accurate enough to make it clear what the use of Big Data offers to each function of the company (clinical, R&D, market access etc).

However, understanding of operations from a digital/Big Data perspective presented a unique challenge to the company. For example, the participants had concerns regarding putting together a systematised data consumption method. Such factors as the frequency of data collection, be it public data, data from partners, or even internal data, as well as the way in which data is collected by different groups using different instruments, mean that the data may not be readily compatible with the Big Data environment. Therefore, the biggest issue was how to coordinate, to validate it, and to check it for accuracy and security before making use of it. Project members believed that increasing the awareness of new opportunities and routine knowledge sharing about this new resource would result in an improved Big Data utilisation process.

> *I think Big Data approach is more integrated into team thinking. So, there is still a need for training, but I think it has to link into an actual project. If you just train someone on a theory, I don't remember it, I don't really care. If you train them on a project and they have to have that information, then you're much more successful.*

*And by demonstrating the value, you then build the interest. By building the interest, you can prioritise budget or resources to do that in the future. On the second side, I'd say it is sometimes manager's decisions, because if you have a group that understands the value or is dealing with lots of data and has more opportunity now, let's say, for the IKU support, then there's already a decision to prioritise those resources.* ***IE14***

#### *5.3.3.2 Other Resources (CF. 2.2)*

***- Increase Awareness and Building Trust***

Participants asserted that the company believed that successful implementation of the technological changes needed to make use of Big Data had to be driven by people with the necessary expertise and business knowledge. Therefore, it was considered an important step that the global site and its affiliates had shared consistent standards for strategy and good governance. Furthermore, project members believed that practices such as communication, as well as education and training, could get people thinking differently such that they could start building new capabilities within their part of the business.

A majority of informants also highlighted that new business insights, attitudes, and views through which people experience new situation helped to identify and develop required capabilities. For example, one of the European country's leaders stated that:

*It is important to increase awareness and train more of each function, or of each country to think about Big Data and think about that approach to answer a question, versus going back to the old-fashioned way. I think that training aspect and that… Training and communication need to be done to help support and prioritise Big Data as a solution and to identify and build required capabilities.* ***IE08***

One of the best examples of such activities, of supporting and prioritising Big Data initiatives, was the priority given by project members in every affiliate to promoting the Big Data initiatives, to increase awareness and commitment, and to achieve change acceptance. Furthermore, by using different techniques such as presenting successful examples of Big Data projects, learning from examples of *Synapse* usage in the Global site or other franchises, and delivering workshops to help affiliates define the value of and objectives for taking on new opportunities, the main aim of this initiative was to increase awareness in every part of the corporation.

For example, one of the interviewees spoke about this role as follows:

> *My objective is make first every person in this affiliate aware what Big Data project is, what the opportunities are. I'm doing this by presenting IKU/ Big Data examples of IKU usage in other countries and territories to small teams, to bigger teams and to bring people to use Synapse, the Synapse platform. So my objective is to have, let's say, half of staff here using Synapse, or at least to be aware and have seen the platform.* ***IE09***

In line with this point the director of the company's French affiliate explained:

> *I mean this is the team spirit that we have here, so I can speak for my affiliate, for our affiliate. It's how people cooperate cross-functional. So when I experience this every day in my job, I can talk to market access, marketing, medical people speak about commercial stuff, commercial people speak, are very, very knowledgeable in medical stuff. So the cross-functionality, the... let's say open-mindedness, the, this company still is very innovative how they approach challenges. But this is what comes to my mind first, so people, flexibility, speed, innovation.****IE01***

Another interesting insight from the data was that the actual demand for data science in general in Europe is very low because there is little awareness of how people can benefit from it. Therefore, project members were hoping that the kinds of practices mentioned above would have a positive impact on changing mind-sets regarding Big Data, and help generate demand and commitment.

*Most probably we'll need more than what we currently have. Because typically when you think about the actual demand or data science demand in Europe, it's very low because there is little awareness of what we can build or what we can have, what people can benefit from. Now in six months, 12 months, years' time people should be aware of that existing capability and the ones that have the IKU mind-set will start generating demands. Saying I need the data science team to do this or I need your help to do that etcetera and this is where we need to be ready to answer the demands.*

***IE05***

Regarding this point, another European leader also commented:

*Just thinking for Europe the biggest challenge I see is because we're just in this process of getting started there's pressure from the countries to set... show us cases where this could provide value to us. So, that's one potential threat if we can't successfully get countries understanding what value this can provide to them. So I think it takes the accumulation of seeing it be useful in a number of projects for it to become generally accepted as a way of doing things, and again that just takes time.*

***IE13***

However, it has been also acknowledged that demonstrating what results can be directly attributed to Big Data is a difficult problem, and so people should be given the opportunity to understand, discover, and learn more before they commit.

Great significance was found to be attached to the practices that support learning on an ongoing basis, such as enabling employees to share and refine their best practices, or to hire external experts to deliver up-to-date learning. For example, a key suggestion about how to support problem-solving and creative thinking was to create an interface through which people could experience and manipulate novel ways of using this new resource.

As the Director of IT, IT EA, and Information Management proposed :

*To create interfaces through which people, without deep data expertise, can view and manipulate these data and do some simple analyses, so you're really getting it out there to people. Because then, you know, they'll be able to do something on their own, they'll start to see the benefit, and then they'll get interested in more complex questions, which they won't know how to do on their own.* ***IE06***

The EMEA project's objective, to increase awareness, and to create commitment and a shared vision which would become integrated into the corporate culture, was believed to have a transformative effect on the company. This has also been considered as a strong influential factor for developing new or enhancing existing capabilities for effective use of Big Data at the EMEA. As the project's leader explained:

*For the vision, for me the project has the potential to be completely transformative, as I said we do trials, we talk to payers, to regulators and ultimately serve our patients. Of course we want to have better outcome for patients by accelerating the time we do trials, by working together with regulators and with payers to make… to have a better value package for drugs. But that's the longer term objectives but main at the moment is to create a shared vision* ***IE09***

#### *5.3.3.3 Path Dependency (CF.2.2)*

***- Shaping the Organisational Culture***

Similar to the US project, organisational culture and cultural transformation were also considered to be major challenges between the participants at EMEA. However, the positive side of the organisational culture - such as an innovative spirit, risk-taking, and flexibility were also found to be the main drivers for the project. For example, one of the participants recalled that:

*The spirit of the company. So the spirit is based on the values that you may know. And particularly the focus on the patient and things like this, but also the innovation spirit.*

*And what I like is that company is not afraid to take risks. I remember one advice that I heard, in my first beginning with project and I think this is exactly summarising the spirit in company… we are not afraid to fail fast because we learn fast.* ***IE04***

The organisational values appears to have both stimulated and limited the pursuit of an innovative, cross-unit Big Data project. National trends and boundaries that were evident within the corporation represented greater challenges at EMEA, and convincing everybody to accept innovative ideas and changes was found to be harder in the European countries.

The Senior Director of Corporate Affairs explained that:

*The culture of the company being far from risk-averse, we are open to change, and take those risks to enable potential change. So I think that's the general culture but it's not everybody's. it's certainly very difficult to convince someone who doesn't want to be convinced. We have, have almost ….. people, or whatever it is now, in our organisation, obviously not everybody is fully on board, right? It comes back to that mind-set of, this is the way we've discovered and developed drugs my entire career, why would we do it drastically different now?* ***IE05***

One of the greatest challenges that emerged from the data was likewise not related to technology and required skills, but to the process of cultural transformation. Issues relating to a change of culture involved people, open-mindedness, changing mind-sets regarding data silos, and the acceptance of new Big Data initiatives. As the Director of IT explained, because of its nature, the majority of IT employees in the pharmaceutical industry traditionally have a very strong data science background. Before Big Data, and even before the IT revolution, pharmaceuticals were very much involved in data processing. While many workers are familiar with the established data tools, and work with data on a daily basis, they see it as just an extension of their toolbox. However, this means that there is a need to recognise a new demand to culturally adopt the new data environment. For example, one participant commented that:

*So for them it's a natural move… It is not about technology and capabilities it is about mind-set and changing culture.* ***IE02***

In line with this point the Executive Director of Global Affairs stated:

*First is a cultural change within the company, as the company like many other pharmaceutical companies has grown as quite a traditional pharmaceutical company, and so we have to adapt to this new world. It is important at all level to change the mind sets and having us at senior management level and different functions understand that we have to change to leverage Big Data. So that's a cultural change.* ***IE10***

The need for cultural change and the importance of change acceptance emerged as a strong theme from other informants' data:

*So, initially for people it's basically just a time set, right, and so they need to be either desperate enough with their current situation, or, you know, sufficiently open to and sort of interested in the possibilities of working more with data, that they're willing to put that in.  , You just need some time for people to be able to look at those data, make some decisions based on those data, and ultimately, hopefully see that those decisions are helping.  So, those are the challenges, and it's really all around acceptance rather than technical things.* ***IE06***

Besides open-minded thinking and change acceptance, almost all informants from the EMEA site (similar to the Global site) named changing the data silo mind-set as ongoing challenge to cultural transformation. Further findings indicate that an ability to become more data-driven requires a mind-set shift within the entire company. Data also suggest that the most significant efforts the company made was to break down the silo thinking that appeared to be common across different factions, franchises, and countries.

For example, the Executive Director of the project explained that implementing and using the new connectivity platform was a good example of such efforts. People in certain departments had access to certain data sources, which they leveraged only for their own interest and function. The same data could have been shared with other departments for their own interest, but in many cases different departments had no idea that data were available. Therefore, either they never used it, or effort and money had been wasted by obtaining potentially duplicated (or at least, similar) data. Analysis of the data indicates that having the right mind-set promotes collaboration, and sharing, and hence the efficient conduct of business. Participants believed that connectivity, clear communication, and coordination had helped prevent duplication of activities (and duplication of expenditure) within different functions and countries, with a consequent positive effect on cost-saving. It has been acknowledged that:

> *You need to kind of put your more reasonable hat on as well, and say, that's wrong to tie that up, right, we need to fuel the ecosystem, because if everybody does that, we will all benefit from the greater amount of data that's available. So, it's really deep cultural roots that I think help change that, change that mind-set.* ***IE10***

### *5.3.4 Existing Capabilities (CF. 3.1)*

The project members believed that, in line with the Global site's existing capabilities that were identified and discussed earlier in this chapter (table 5.1 and 5.2), the EMEA site also featured good IT and marketing capabilities. However, according to one of the project directors, these capabilities had been evolving slowly, and there was also demand for new capabilities.

> *I think what we will be needing is more capabilities. Some of them will be technical. Not everyone needs to have them within IKU. But, we need to have enough people to have those capabilities and scientific analysis is one of them that I mentioned. But, also [unclear] initiation and collaboration skills. You need to be growing to the next level. As I mentioned, there are several things that are held outside the company and*

*we need to negotiate to get access to that. The capabilities that we have, are evolving and we need to keep this way* ***IE12***

#### *5.3.4.1 Marketing Capabilities (CF. 3.1.1)*

Participants expressed pride in the company's success in the markets, and believed that this was down to having strong marketing capabilities, not only at the Global site but also at EMEA. As the Executive Director of the IKU project explained:

*The company is a highly successful biotech company of 7000 people with a market cap of $100 billion. So if you put this as a ratio and you look at the biotech, it's remarkable. So we've been a highly successful company and that has been mainly through the success of one asset that is called Revlimid* ***IE09***

Although the company was proud of some specific drugs that had come to dominate the market, they were clear that their success was due to not relying on one product but, rather, having the ability to diversify its portfolio and provide for patients with various conditions. The company achieved this diversity, in part, as the result of establishing a new franchise, inflammatory immunology. With new assets serving the different market segments (patients with psoriasis, psoriatic arthritis, rheumatism, and skin disease) the company demonstrated its ability not to rely on one product, in an industry in which unique assets tend to mature and ultimately be replaced by *'generics'*. This consequently demonstrates the company's emerging market capabilities.

Moreover, monitoring customers, competitors, and the market itself so that in each case the company could react to its own advantage was also identified as an important marketing capability at EMEA.

The company's EMEA site marketing capabilities are summarised in table 5.8 below.

| Definition (Marketing Capabilities) Examples in the literature (Authors) | Operational Capability | Appearance in the Case Study | Direct Quotes (comments) from Interviews and Secondary Data Comment |
|---|---|---|---|
| Marketing capabilities are Integrating process (e.g. build sustainable relationships with customers, knowledge of the competition and as well as skills in segmenting and targeting markets) in which the firm use its tangible and intangible resource and capabilities to understand the trajectory of customer needs through effective information acquisition, management, and use (Day, 1994; Dutta et al, 1999; Song et al, 2007; Krasnikov and Jayachandran, 2008, Morgan, 2009) | Integrated process, in which the firm uses its tangible and intangible resources to build sustainable relationships with customers | Ability to create effective drugs, going through the various clinical trial phases, and having the commercial infrastructure to deliver innovative treatment to patients. | *The company is a highly successful biotech company of 7000 people with a market cap of $100 billion. So if you put this as a ratio and you look at the biotech, it's remarkable. So we've been a highly successful company and that has been mainly through the success of one asset that is called Revlimid.**IE09*** |
| | Ability to identify emerging markets | The company diversified its portfolio, through the emergence of a new franchise, *inflammatory immunology*. | |
| | Monitoring customers and competitors | With new assets, serving patients with psoriasis, psoriatic arthritis, rheumatism, and skin diseases, the company demonstrated its ability not to rely on one product, in an industry in which this this asset will mature and ultimately be replaced by 'generics' | *Our world is changing. Look at the Uber, the Amazon, the company… the Airbnb. So our world is changing, not only our world is changing, our industry is changing.**IE09*** |
| | | Patients and payers who rationalise the price of products by making their success in Big Data environment, were pressuring global leaders to react more quickly than ever to transform their businesses to compete in a new business environment as the market and technologies are changing | |

*Table 5.8: Marketing Capabilities (CF 3.1.2) (Author's own)*

#### 5.3.4.2 IT Capabilities (CF. 3.1.2)

It was found that the EMEA site was equipped with the IT infrastructure and employees with strengths in data science, governance, taxonomy, and other skills needed in order to harness Big Data opportunities. However, project members still had concerns related to their IT capabilities. These mainly concerned the ability to coordinate change amongst various functions and franchises (Marketing, IT, policy, and different countries). At the beginning of the project these employees were not sure how different functions and franchises would be able to make use of the processes and IT tools necessary for Big Data adoption that had been established by the Global site.

As the project director explained:

> *I think one challenge that we are currently facing is that now that the capability is being built, the questions come, what will be the operating model? And who shall lead it and how shall it be embedded in the business, functions and franchises? Because you know, once people understand that… what you can do with data science, that you have the right platform and you have the data science available, you don't need people like me anymore. It could be directly embedded in the business or should it be embedded maybe with IT or specifically? So those are the questions we are having now, what should be the proper operating model?* ***IE05***

Another common concern among the informants related to setting up new initiatives and the technological platform that would support them; the Global team had not fully considered how such developments at their site would be implemented in outside the US. For example, some of the participants highlighted that the new platform was built for US data and so was difficult to fully understand and put into operation at the EMEA site, meaning that before it could be used some changes would be necessary. As one of the European country leaders explained:

> *I would say we have to find a clear path and strategy how this fits into our business model here locally. And the big challenge here,…, is that it's not something that's ready to be rolled out here The big, big challenge that we are facing with IKU and Synapse is the impression that this is still very, very US focused. Then, so the people that I have motivated to go to Synapse, they look into Synapse, they do it and these are the highly motivated persons and colleagues and they see; oh there is a lot of US stuff, this doesn't help with my local challenges.* ***IE11***

Another participant from a different country also commented:

*Our concern is, still how does IKU fit into our business processes, and operational models, and how to Europeanalise this whole thing. How to make this really tangible for people sitting here on this side of the pond.* ***IE08***

Participants also identified a need for there to be embedded in each function additional resources skilled in analytics, and capable of understanding the benefits of Big Data and how new solutions could be linked to their own function. As one of the project members expanded, there was a need for additional in-house capabilities:

*In different functions you have some gaps and we need to bring in capacity and capabilities in house so not to be over dependent on external partners.* ***IE08***

The project director also commented on this topic, adding:

*Now we are building a centralised kind of team, project team but that ultimately should not be central anymore because it should belongs to the functions and the affiliates and the markets. Therefore we need additional skills imbedded in the functions and franchises.* ***IE05***

Furthermore, participants believed that the successful implementation of a new unfamiliar technological system requires suitable processes to be established, and for staff with adequate and relevant skills to be available before the system can be put to productive use. As one of the external partners who was helping the company with the project explained:

*This is the skill set you need to start hiring for, because the question you have, we helped you reframe the question to be applicable in this new world, helped you find the data sets, helped you to define the use case, and based on that process you have some kind of a visibility and a skill set you might want to start thinking about getting access to yourself.* ***IE16***

The emergence of new skills that could speed up the implementation process and help different functions create a community of practice around new technology and data management was found to be an essential factor for the transformational phase. However, it was also acknowledged that it is often impossible to assemble all of the required new skills at the same time. Therefore it was agreed that it was important to adapt the existing system to the new environment. Overall, participants indicated that for some stages, such as the preparation and building phases, the company could rely on internal skills and the experience of external partners to enhance and build required capabilities, with it being highly recommended that suitable personnel were hired for the operational phase.

Table 5.9 below summarise the company's IT capabilities.

| **Definition (IT Capabilities) Examples in the literature (Authors)** | **Operational Capability** | **Appearance in The Case Study Company** | **Direct Quotes (comments) from Interviews and Secondary Data Comment** |
|---|---|---|---|
| An organisation's ability to assemble and to deploy IT based resources in combination with other organisation's existing resources and capabilities Examples of such abilities include business process reengineering, integrate required IT into appropriate business processes, customer relationship management, electronic commerce, new resource adoption and managing digital data (Vitari et al, 2012; Chen et al., 2012; Wilden and Gudergan, 2015 ). | Integrate required IT into appropriate business processes.<br><br>New resource adoption and managing | The technological infrastructure and a group of people, with various abilities of data science, governance, taxonomy, and data ingestion. Data quality checks or good information management.<br><br>Big Data initiatives implementation | |

*Table 5.9: IT Capabilities (CF 3.1.2) (Author's own)*

### *5.3.5 Dynamic Capabilities (CF. 3.2)*

#### *5.3.5.1 Reconfiguration (DC) (CF. 3.2.3)*

The empirical investigation at the Global side suggested that its technological (IT) and connectivity capabilities had been enhanced through the company's reconfiguration ability. Through networking and partnerships in particular, the company was able to determine which of the different internal work streams, resources, and capabilities had to be re-engineered in order to fully leverage Big Data. Findings from EMEA confirmed that increasing awareness regarding Big Data opportunities, as well as the company's new connectivity platform *Synapse,* played important roles to develop Big Data capabilities at EMEA. However, the company's cultural transformation, its ability to learn through innovation, and emphasis on the value of risk-taking, also had important roles to play in defining and building required capabilities for Big Data within EMEA. For example, participants described this process as being similar to building a house. The connectivity, and an IT platform that could support it, were considered to be the foundations. However, once the foundations were laid a further demand for new skills and capabilities were identified.

As the project director explained:

> *There are two foundational elements in our mind, one is what we call your connective tissue. If you don't have a platform in place that has the capabilities of working across functions, across therapeutic areas, consolidating all the various data assets and analytical tools, then we won't be able to move away from this very typical silo thinking. and we've built a technological platform to address that connectivity challenge.* ***IE02***

These new skill sets, identified as being necessary for innovation, were also developing in collaboration with the partnerships. Partnering up with other companies with expertise in the field, such as Deloitte (same company as US site), enabled the company to start Big Data initiatives even without having all the skills in-house. The IT gap was gradually filled through learning and the overall evolving processes.

Table 5.10 below summarises the company's reconfiguration ability.

| Definition (Reconfiguration Capabilities) Examples in the literature (Authors) | Dynamic Capability | Appearance in The Case Study Company | Direct Quotes (comments) from Interviews and Secondary Data Comment |
|---|---|---|---|
| Reconfiguration (Box. 3.2.3) is an organisation's ability to extend and modify existing capabilities in response to changes introduced in the market and technologies that are generated through new knowledge based on Big Data (Teece, 2007; Kwon, et al., 2014). | Ability to determine (seize), the different internal work streams, resources, and capabilities that had to be re-engineered in order to fully leverage Big Data<br><br>Ability for cultural transformation | Data harmonization.<br><br>The company's new digital platform, a cloud-based data environment, which enables connectivity of different functions and scales up as required for analytical needs | *These new skillsets and expertise enable us to realize the value of data across the organization and help increase the entire organization's acumen around data and analytics.* ***ID01***<br><br>*There are two foundational elements in our mind, one is what we call your connective tissue. If you don't have a platform in place that has the capabilities of working across functions, across therapeutic areas, consolidating all the various data assets and analytical tools* ***IE02*** |

*Table 5.10: Reconfiguration (CF. 4.3) (Author's own)*

#### 5.3.5.2 Strategic Competitive Response (CF. 3.2.1)

Once the mechanisms for the support of Big Data initiatives established internally, the abilities of sensing and seizing allowed the team members to determine whether the company had the internal capabilities to address the pre-identified objectives for Big Data. The team members spent considerable time - one or two years – engaged in work, talking to business partners and commercial partners, getting advice about how to reorganise EMEA. They also engaged with policy stakeholders, public institutions, legislators, the European commission, and others.

In addition, the project members, together with the company's own data scientists, collaborated with different stakeholders, such as business owners, functions, and specific groups (clinical, R&D) to determine whether the company had enough data and a suitable technological solution in-house, or if there was a need to engage in new networking with Big Data partners, and find other technological solutions. As one of the senior leaders commented:

> *The IKU/Big Data team is after spending one or two years doing some inward work getting advice to reorganise and talking to business partners and commercial partners, is now getting ready to engage with the broader policy stakeholders, public institutions, legislators, European commission and others, and SGR and this IMI consortium seems to be the right channel.*

> *We still a need and develop a fully-fledged strategy that we can call, you know, the Big Data/health data policy shaping strategy at the company. That should happen between now and the end of the year. So next year we can gauge which key strategic objectives in mind.* ***IE10***

With SGR (Scientists for Global Responsibility) the participant was referring to a UK group that promotes the ethical practice and use of science and technology, while IMI stands for the Innovative Medicines Initiative, a European organisation set up to improve the competitive situation of the European Union in the field of pharmaceutical research.

Another interesting insight from the data underlined the company's strategic competitive response ability, specifically its ability to be opportunistic in the sensing and seizing of Big Data opportunities. The company used this approach when looking for partnerships, not only with a specific business question in mind, but rather as a general standard/best practice. For example, they sought to collaborate with companies which were successful and could help to make a transformational impact not only on the company but also on the healthcare ecosystem in general.

The Executive Director of Data Governance explained:

> *We liaised with an external company that had a lot of experience in dealing with Big Data, to help us set up the capability, all of the technological solutions, so we're building that network through communicating with experts in that area, and that's how we really find out about opportunities, solutions, that may help address our business questions* ***IE07***

Another good example was the company's engagement with the European Huntington's Disease Network (EHDN). Huntington's is a genetic disorder that causes the death of brain cells. The EHDN is a non-profit research network committed to advancing research, facilitating the conduct of clinical trials, and improving clinical care in Huntington's Disease. Through the

EHDN a platform has been created such that scientists, clinicians, patients, and families can collaborate on academic and industry studies to fulfil its mission. As one of the participants explained, it represents a great opportunity to engage with the EHDN as it was a suitable channel to establish and learn from health data infrastructure.

> *EHDN was calling for potential partners for the summer, we thought it was the right time for us to piggyback and enjoy these efforts because not… EHDN and the other IMI consortium are not just interested in shaping policy, but EHDN seems to be the right channel and forum to establish the health data infrastructure.* ***IE10***

Furthermore, in line with findings from the global site, the knowledge integration and learning processes played important roles during the Big Data preparation process in EMEA.

Table 5.11 summarises the company's strategic competitive response activities that are discussed above.

| **Definition (Strategic Competitive Response Capabilities) Examples in the literature (Authors)** | **Dynamic Capability** | **Appearance in The Case Study Company** | **Direct Quotes (comments) from Interviews and Secondary Data Comment** |
|---|---|---|---|
| Strategic competitive response capability is the firm's as the ability to sense/scan the environment, identify new opportunities, assess its competitive position, and respond to competitive strategic moves. (Teece, 2009, p.200). | Sensing (and shaping) new opportunities are very much a scanning, creation, learning and interpretation activity (Teece, 2009). | The IKU project was the result of a lot of hallway conversations between very senior leadership, to make sense of what the Big Data environment meant for the company<br><br>The team members spent considerable time – one or two years – engaged in work, talking to business partners and commercial partners | *The IKU/Big Data team is after spending one or two years doing some inward* ***IE10*** |
| | Seizing refers to the organisational strategy and infrastructure for making appropriate decisions and absorbing and integrating resources to create and capture value from opportunities (Teece, 2009). | The project members, together with the company's own data scientists, collaborated with different stakeholders, such as business owners, functions, and specific groups (clinical, R&D) to determine whether the company had enough data and a suitable technological solution in-house, or if there was a need to engage in new networking with Big Data partners, and to find other technological solutions. | *work getting advice to reorganise and talking to business partners and commercial partners, is now getting ready to engage with the broader policy stakeholders, public institutions, legislators, European commission and others, and SGR and this IMI consortium seems to be the right channel.* ***IE10*** |

| | | | |
|---|---|---|---|
| | Respond to competitive strategic moves. Maintain competitiveness through enhancing, combining and reconfiguring (when necessary) an organisation's existing and new resource and capabilities. (Teece, 2009). | An opportunistic approach was another innovative activity that the company took to sense and seize the Big Data opportunities | *We liaised with an external company that had a lot of experience in dealing with Big Data, to help us set up the capability, all of the technological solutions, so we're building that network through communicating with experts in that area, and that's how we really find out about opportunities, solutions, that may help address our business questions* ***IE07*** |

*Table 5.11: Strategic Competitive Response (CF.3.2.1) (Author's own)*

#### 5.3.5.3 Learning (DC) (CF. 3.2.2)

In addition to the immersion experiences that were organised by the Global site for the entire organisation, participants from EMEA indicated that internal knowledge was improved through learning by experimentation, innovation, and risk taking. This resulted in the development of new Big Data-enabled capabilities within this part of the company. Almost all participants believed that taking risks and investing in the ecosystem of learning, and exploring different practices – even those not of direct benefit to the company - may have contributed to the project's success. However, that investment needed to be relevant to the innovation and required capabilities. A good example was the effort made to identify, provide, and demonstrate tangible examples of the use cases to the broader audience. This is believed to have had an immediate impact on those individuals who had not been fully engaged with the new evolving ecosystem. One of the participants recalled:

> *Taking- risk to gain the first-hand experience gave me lots of freedom to try new things and sometimes didn't work but was ok, because also our culture said, that within reason we should take risks and accept that not everything is going to work, we'll learn from those mistakes and then we'll evolve and move on.* ***IE16***

The Director of Medical Affairs also indicated that:

> *Well it's… first of all it's an innovation project. That's the whole thing about innovation. It's risk, I saw quite a lot of activities, which were purely in exploration and learning mode to build capabilities, and then now we are trying to figure out*

*what is the best way to leverage those capabilities in their specific business cases.* ***IE10***

The exploration and learning mode referred to above consisted of several innovative practices that were related to new ideas. For example one of the ideas - cross-learning (and sharing through: The European in Informed Activity (EIA), was - focused on the use of real-world data, and attracted funding from the European Commission's programme. Moreover, the regular champions' meeting, held every two weeks and led by the director of the project from the EMEA site, was a good example of the company's internal cross-learning activity. At these meetings the champions had a chance to get together to address and resolve current issues, and as an outcome other employees could obtain regular updates on processes, trainings, workshops, and those affiliates in which the champions had identified use cases. The IKU checking team could track the progress of these use cases, and this team reported at regular meetings what each affiliate was doing and whether there were any new practices that could be shared or learned from.

One of the European countries' site leaders explained:

> *It's a top down approach, new idea is presented to the management team, so we meet every week, the department heads. This is a small team, around ten persons. We sit together, we have presentations if new stuff comes in, and this team is discussing how we can implement this through the organisation.* ***IE08***

The 'new stuff' mentioned by the participant referred to a new potential IKU champion from a different department or franchise, or a new employee with adequate Big Data knowledge. In addition, regarding team meetings and discussions, another senior manager recalled the cross-functional team meeting discussion, which had a slightly different approach from the team meeting discussions mentioned above:

*But we also have cross-functional teams, for example, within my life cycle management team function I'm overseeing four core teams focusing on qualities, different pipeline assets. And this is, these are people from all departments, and we are discussing innovative approaches here as well. So on this angle this is more about another approach. If we deem an idea to be great and now we have a, we present then this to the management team, to the short fix that we have every Monday, and seek for endorsement here. So we have processes in place to hear all proposals and innovations and take it for decisions how to proceed.* ***IE08***

Analysis of the data showed that innovative practices required an investment of time, in order to allow people the chance to experience and observe the relationship between new ideas and actions within the business. However, regardless of the required time and risk associated with an innovation, it was evidenced that innovative practices were important all the way through the capability development process for the Big Data initiatives in the case study company. This was acknowledged and accepted by senior leaders. As one of them highlighted:

*You have to let people play around with this a bit, you see. And you have to accept to invest sometimes in things you do not really fully apprehend from the beginning. That's the whole thing about innovation. It's risk.* ***IE02***

With regards to this matter another participant also commented:

*So, initially for people it's basically just a time set, right, and so they need to be either desperate enough with their current situation, or, you know, sufficiently open to and sort of interested in the possibilities of working more with data, that they're willing to put that in. And then of course, as I think I was talking about a little bit earlier, you just need some time for people to be able to look at those data, make some decisions based on those data, and ultimately, hopefully see that those decisions are helping.*

*So, those are the challenges, and it's really all around acceptance rather than technical things.* ***IE11***

A risk-taking and innovative approach, combined with learning and trial and error, enabled project members to develop new solutions and support Big Data initiatives as they continued their day-to-day operational activities (IT or marketing). Despite this, it remained a considerable challenge to learn how to integrate and utilise the new connectivity platform with internal resources. As the Director of IT explained:

*The platform is entirely new, it's like on top of company's existing capacity from technical point of view. So the challenges, of course we would have challenges, because you have to find ways to integrate it with the company's existing environment, you have to find the best ways to support it. And then of course you will have to learn how to efficiently support it.* ***IE02***

However, participants showed great appreciation for experiencing those challenges in their journey of identifying and defining Big Data required capabilities. Findings from the data indicate that when the objective to build transformational capabilities that will stimulate insight across the corporation, the application of leadership skills and problem-solving skills from different parts of the business enables to the identification of capabilities that will be relevant to the next learning curve.

*It's kind of an evolving process situation, we're learning at the same time…you know, I think it's a better position to be in, that instead of just like, yes, we need lots of people, and we bring lots of people in, and we go, actually, we didn't need that, it's better we take the approach of, learn from, you know, on a weekly basis, where the gaps are, and where they are, fill the gaps, in that perspective.* ***IE09***

However, although the processes described above had positive implications, most of the informants were also clear that investment in new skills would be necessary for a transformation to be successful.

Table 5.12 below summarises the company's learning capabilities

| **Definition (Marketing Capabilities) Examples in the literature (Authors)** | **Dynamic Capability** | **Appearance in The Case Study Company** | **Direct quotes (comments) from Interviews and Secondary Data Comment** |
|---|---|---|---|
| Learning (Box. 3.2.2 CF) is defined as 'the capacity or process within an organisation to improve or maintain performance based on experience accumulation, knowledge articulation and knowledge codification (Nevis et al., 1995, p 73, Zollo and Winter,2002). To develop learning capabilities: Management should support employees for learning, Managers should be open minded for new ideas, knowledge and experiences should be openly shared within the firm ( Inan and Bititci, 2015). | Experience accumulation refers to the central learning process by which operating routines have traditionally been thought to develop. Incremental improvements can be accomplished through the tacit accumulation of experience and acts of creativity (Zollo and Winter, 2002) | Internal knowledge was improved through learning by experimentation, innovation, and risk taking, which resulted in the development of new Big Data capabilities within the company.<br><br>Innovative practices related to new ideas. For example activity such as Cross learning and sharing through: the European in Informed Activity (EIA), paid by the European commission focusing on the use of real-world data. | *Taking- risk to gain the first-hand experience gave me lots of freedom to try new things and sometimes didn't work but was ok, because also our culture said, that within reason we should take risks and accept that not everything is going to work, we'll learn from those mistakes and then we'll evolve and move on.* ***IE16***<br>*I saw quite a lot of activities, which were purely in exploration and learning mode to build capabilities, and then now we are trying to figure out what is the best way to leverage those capabilities in their specific business cases.* ***IE10*** |
| | Knowledge articulation The process through which implicit knowledge is articulated through collective discussions, de-briefing sessions and performance evaluation processes. By sharing their individual experiences and comparing their opinions with those of their colleagues, organisation members can achieve an improved level of understanding of the causal mechanisms intervening between the actions required to execute a certain task and the performance outcomes produced (Zollo and Winter, 2002) | Identifying, providing and demonstrating tangible examples of the use cases to the broader audience.<br><br>The regular champion's meeting (every two weeks) led by the director of the project from EMEA site, was a good example of the company's internal cross learning activity. | *it's a top down approach, new idea is presented to the management team, so we meet every week, the department heads. This is a small team, around ten persons, and the GM. We sit together, we have presentations if new stuff comes in, and this team is discussing how we can implement this through the organisation.* ***IE08***<br><br>*But we also have cross-functional teams, for example, within my life cycle management team function I'm overseeing four core teams focusing on qualities, different pipeline as-sets. And this is, these are people from all departments, and we are discussing innovative approaches here as well* ***IE08*** |
| | Knowledge codification Knowledge codification is a step beyond knowledge articulation. It aims to uncover the linkages between actions and performance outcomes. Most of them are intended simply to | The IKU checking team who had a separate track on the progress of these use cases. The team was reporting on the regular meetings what each affiliates were doing and whether there were any new practice that could be shared, from where others could learn. | *It's kind of an evolving process situation, we're learning at the same time…you know, I think it's a better position to be in, that instead of just like, yes, we need lots of people, and we bring lots of people in, and we go, actually, we didn't need that, it's better we take the approach of, learn from, you know, on a weekly basis, where the gaps* |

| | | | |
|---|---|---|---|
| | provide guidelines for the execution of future tasks. | | *are, and where they are, fill the gaps, in that perspective.* ***IE09*** |
| | Managers should be open-minded to new ideas. | Identifying what the Big Data meant for the company was an initial learning activity as part of the learning journey that project members went through at the early stages of the planning phase.<br>Help the company learn how to embed Big Data into their functions/franchises and day-to-day work in order to operate in a new digital world. | *It was a group of 20 individuals across 7,500 global individuals, where we're trying to influence and change the way we think. Right? And what we've found in this journey is we will not be successful with an approach of forcing people to do this. Where we've found success is finding what we refer to as like-mindedness.****IE05*** |

*Table 5.12: Learning (CF.3.2.3) (Author's own)*

#### *5.3.5.4 Coordination (DC) (CF. 3.2.4)*

In addition to having the capability to gain appropriate insights from Big Data, it is also vital to communicate and coordinate those insights, both internally and externally. The EMEA participants had strong opinions on this, believing that coordination is an important ability that enhances the linkage between all stakeholders in drug R&D, commercialisation, and delivery. It emerged that communication and coordination among different functions was improved and maximised via use case demonstrations.

As one of the senior directors explained:

> *I mean you see some groups/ functions that, because of different use cases we've done, see the value and then completely open up and say oh, we must share our data, and to be honest, there are teams that don't have.. countries for example, they don't have data and they are willing to open up and help as possible because they know it will enable them to get access to the data that they currently don't have because the US team keeps it.* ***IE13***

Although the new connectivity platform allowed effective coordination, participants explained that there was also a great number of horizontal communication exchanges that took place between different franchises within the countries. The company also tried out innovative ways to promote vertical communication in order to align different company functions/operations (for example, between sales and marketing). For example, the market access department would promote vertical communication with other functions, such as medical, or commerce. Participants believed that this streamlined approach would lead to more effective coordination of functions across different countries.

The company's coordination capabilities are summarised in table 5.13 below.

| **Definition (Coordination Capabilities) Examples in the literature (Authors)** | **Dynamic Capability** | **Appearance in The Case Study Company** | **Direct quotes (comments) from Interviews and Secondary Data Comment** |
|---|---|---|---|
| Coordination (Box. 3.2.4) Capabilities/processes connect and interface single activities through communication, scheduling, task assignment, collaboration, and other related activities. This is an important capability to deal with the changing business environment especially in Big Data case when there are fewer experiences and less good practice implications. Protogerou et al., (2011) | Processes to connect and interface single activities through communication<br><br>Scheduling, task assignment | By demonstrating some of the use cases participants believed that they were able to improve linkage among different functions and maximised internal coordination.<br>Improve coordination capabilities - there were lot of exchanges between different trades horizontally in the country.<br>Innovative ways of promoting vertical communication. In this way the project members tried to align functions/operations across official kind of trades. | *I mean you see some groups/ functions that, because of different use cases we've done, see the value and then completely open up and say oh, we must share our data, and to be honest, there are teams that don't have.. countries for example, they don't have data and they are willing to open up and help as possible because they know it will enable them to get access to the data that they currently don't have because the US team keeps it.* ***IE13*** |

*Table 5.13: Coordination Capabilities (CF. 2.3.4) (Author's own)*

### *5.3.6 Changed Capabilities in Response to New Opportunities (CF. 4)*

As a result of ongoing learning efforts, the project members from EMEA were able to name several new capabilities that they had developed that were distinct from and in addition to the connectivity platform and data harmonisation capabilities that had emerged as enhanced or new capabilities at the Global site. For example, referring to such new capabilities, the project director explained that some colleagues in the team had learned how to build dashboards using "*Tableau",* business intelligence software that helps people visualise and understand data. This program also allows users to connect to and share any type of data in minutes. Participants stated that this new capability was already in use in some functions/countries, but at their site the company was using *PowerPoint* presentations or *Excel's* manual mapping, preparation of which took a great deal of time. The silo data culture was the cause of these different local practices at each function or country.

The creation of a dashboard that had been developed in collaboration with the company's leadership team using some of the latest data management software indicated the effectiveness of some of the practices that project members undertook in order to develop Big Data capabilities. The project members were proud of achieving such success in quite a short time: The Director IKU Data Science EMEA commented:

> *What we have now is huge. We have an AWS platform, Cloud-based system, with multiple the technologies such as Hadoop and Cloudera, both that sit on it. And, than along with the a full integration to a number of different analytical tools of Python, R, SAS. Than along with the a layer of being able to kind of interpret that data to give real-time analytics to folks through these apps, these custom-developed apps what we've built And visualising that through Tableau. So to me it's kind of like an art work, a piece of art, very nicely constricted together.* ***IE05***

Another new capability that was highlighted during the interviews was that of making use of a *Salesforce*-based portal, where different functions and countries were able to search through the catalogue of data and previous studies. With regards to changes to existing processes and new capabilities the Director of Medical Affairs stated that that the project members had conducted a survey across the different teams to understand the change process, what worked with regards to new capabilities, and what had to be done to make such initiatives more successful. As he explained, there were incremental efficiencies that project members gained in various parts of the business, adding that:

> *This changed the way of the process, yes because now all data sets are merged into one place, one –stop framework. However, really in terms of change management we*

*need to have a right sequence of changes and activities internally so that we don't try to embrace too much.* ***IE10***

The project members believed the new way of treating data, and development of the new work model, were progressing well. However, they also highlighted that there was a need to maintain it as a sustainable capability to support transformation in the longer term. The next short-term plan was to bring those use cases to life more actively as case studies, so that people in the organisation could see the transformational effects and become more engaged, and to think differently and more transformationally about Big Data initiatives. Use cases are good for offering suggestions that describe a particular application for a product or service, and often explain exactly how it's done and why the product or service is the best for the job (Levy, 2014). However, it is important to apply this knowledge at a macro-level before it can be decided whether it represents a good investment.

The company's changed capabilities in response to new opportunities are summarised in table 5.14 below

| **Enhanced or New Capabilities** | **Marketing and IT Capabilities** | **Direct quotes (comments) from Interviews and secondary data Comment** |
|---|---|---|
| Dashboards using *Tableau*<br><br>Salesforce-based Platform | Ability to connect, visualise and share any type of data in minutes. Ability for different functions and countries to search through the catalogue of data and studies that have been conducted before | *Than along with the a layer of being able to kind of interpret that data to give real-time analytics to folks through these apps, these custom-developed apps what we've built And visualising that through Tableau. So to me it's kind of like an art work, a piece of art, very nicely constricted together.* ***IE05*** |

*Table 5.14: Changed or New Capabilities in Response to New Opportunities (CF. 4)*

## 5.3 Summary of EMEA Findings

The overall findings from the EMEA site are presented on Figure 5.3 The findings that are specific to this site are presented in yellow, whereas text in white refers to what EMEA shared with or, in some cases, derived from the Global site. Similarities and differences between the

Global site and EMEA are discussed in detail in the next section (5.4), while the rest of this section summarises the EMEA findings.

It is clear that the Big Data initiative introduced by the Global site brought a transformational change to the site at EMEA, where the site leaders were forced to react quickly to adopt and implement Big Data initiatives in their part of the business. Implementing Big Data initiatives has been acknowledged as an innovative way of conducting business (IE01; IE07; IE09; IE10). Consequently, it was a recognised way towards to the goal of personalised medicines.

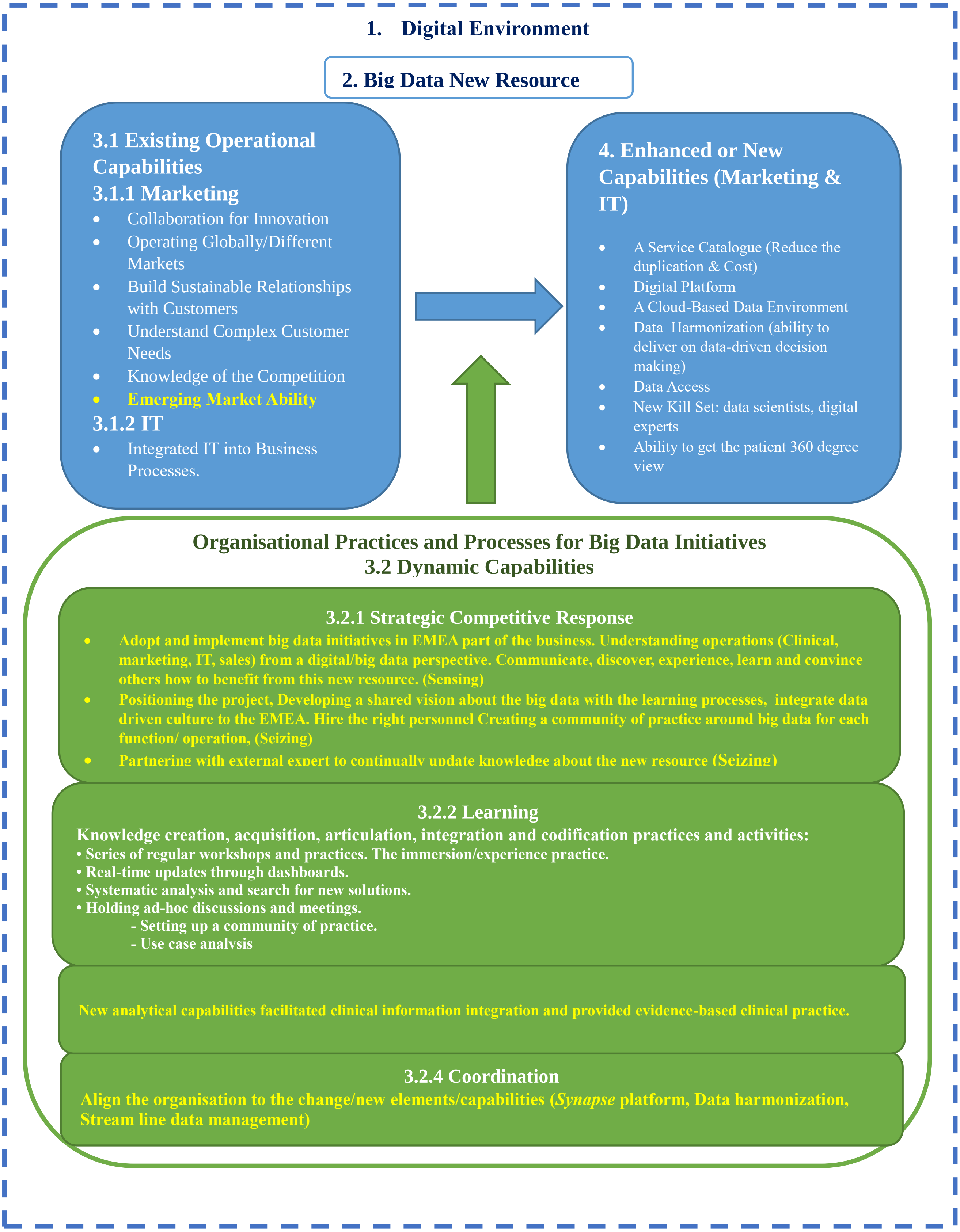
Big Data opportunities at the EMEA site also were associated (IE01; IE02; IE07; IE09) with improving the way in which the company was serving its patients, generating new business opportunities, and speeding up and cheapening business cycle as a whole.

However, after implementing fundamental capabilities that has been developed at the Global site of the company (Fig 5.2, section 4), understanding operations (clinical, marketing, IT, sales) from a digital/Big Data perspective presented a unique challenge to the company. To address this challenge a number of key activities, such as: communicate, discover, experience, learn and convince others how to benefit from this new resource, were utilised within this site (IE02; IE06; IE05; IE06; IE13).

As expressed in section 3.2.1 of figure 5.3, developing a shared vision about the Big Data with the learning processes, which would become integrated into the corporate culture, believed (IE06; IE05; IE10) to have had a transformative effect on the company

The emergence of newer skills which would allow both the effective use of new technology and the creation of a community of practice around it was found to be an essential factor for the transformational phase (IE02; IE08; IE10).

It was evident (IG05; IG08) that for preparation for Big Data initiatives, the company could rely on internal skills, like the combined experience and abilities of the managers, especially when complemented with knowledge derived from networking, to enhance and build required capabilities. However, it was also highly recommended that suitable personnel be hired as part of the transformation phase.



1. Digital Environment
2. Big Data New Resource
3.1 Existing Operational Capabilities
3.1.1 Marketing
• Collaboration for Innovation
• Operating Globally/Different Markets
• Build Sustainable Relationships with Customers
• Understand Complex Customer Needs
• Knowledge of the Competition
• Emerging Market Ability
3.1.2 IT
• Integrated IT into Business Processes.
4. Enhanced or New Capabilities (Marketing & IT)
• A Service Catalogue (Reduce the duplication & Cost)
• Digital Platform
• A Cloud-Based Data Environment
• Data Harmonization (ability to deliver on data-driven decision making)
• Data Access
• New Kill Set: data scientists, digital experts
• Ability to get the patient 360 degree view
Organisational Practices and Processes for Big Data Initiatives
3.2 Dynamic Capabilities
3.2.1 Strategic Competitive Response
• Adopt and implement big data initiatives in EMEA part of the business. Understanding operations (Clinical, marketing, IT, sales) from a digital/big data perspective. Communicate, discover, experience, learn and convince others how to benefit from this new resource. (Sensing)
• Positioning the project, Developing a shared vision about the big data with the learning processes, integrate data driven culture to the EMEA. Hire the right personnel Creating a community of practice around big data for each function/ operation, (Seizing)
• Partnering with external expert to continually update knowledge about the new resource (Seizing)
3.2.2 Learning
Knowledge creation, acquisition, articulation, integration and codification practices and activities:
• Series of regular workshops and practices. The immersion/experience practice.
• Real-time updates through dashboards.
• Systematic analysis and search for new solutions.
• Holding ad-hoc discussions and meetings.
- Setting up a community of practice.
- Use case analysis
New analytical capabilities facilitated clinical information integration and provided evidence-based clinical practice.
3.2.4 Coordination
Align the organisation to the change/new elements/capabilities (*Synapse* platform, Data harmonization, Stream line data management)

*Figure 5.3: The Key Aspects of the Findings from The EMEA Site (Authors own. Developed based on the CF and findings of this study)*

Innovative approaches, such as having an opportunistic approach to respond strategically to challenges and opportunities that resulted from the new initiatives, were also found to be important activities at the EMEA site. Such abilities included networking and partnership with experts in the field to sense and seize Big Data opportunities and create knowledge for use by the EMEA site, although sensing and seizing activities at the EMEA site played a greater role in education than in strategy development. In particular, to enhance their sense and seize capabilities, partners were not chosen on the basis of a specific business question but rather in the pursuit of general education or best practice.  Great importance was attached to networking and partnership in the continual updating of knowledge about the new resource (IE05; IE07; IE10)

Learning processes/activities such as experimentation, innovation, and risk-taking were also prominent at the EMEA site (IE10; IE16).

Different learning practices such as first-hand experience, immersion practises, Cross-learning and sharing new initiatives externally and internally, regular updates on processes (success and failure), training, and workshops were identified at the EMEA site.

In addition to fundamental capabilities that were having transformational effects on the company's operations, EMEA project members were able to improve and expand these capabilities based on knowledge that had been created through the learning processes.

It was also evident that (IE05; IE10) new capabilities (Fig 5.3, section 4) such as the *Tableau* dashboard and the *Salesforce*-based platform replaced old ways (*PowerPoint, Excel*) of managing and visualising data. In particular, these new analytical capabilities facilitated the integration of clinical information and provided evidence-based clinical practice. New systems provide solutions to the problems of processing large volumes of data, manipulating it real-time, and capturing all patients' visual data or medical records. In doing so, this analysis enabled the company to identify fresh business insights, leading to the discovery of previously unnoticed patterns in patients' related needs and future market trends. In this way the company was able to improve both its standards of quality of care and its financial performance. Using new capabilities also enabled the company to streamline and reduce the time spent engaged in data management, and reduced the amount of costly data duplication.

## 5.4. Global (US) vs EMEA

Drawing on the findings presented earlier in sections 5.2 and 5.3 this section discusses the main managerial and organisational activities and processes that have been undertaken by both project teams (Global (US) and EMEA (Europe)) and highlights the similarities and differences between them. Table 5.15 summarises the main similarities and differences between the two projects' processes and activities. For the purpose of clarity, there are two colours in table 5.15, with light-blue representing similarities and dark-blue denoting differences.

| **Main Features and Processes /Activities** | **Similarity (S) Difference (D)** | **USA/Global** | **Europe/EMEA** |
|---|---|---|---|
| The company's Big Data Initiative's Aim / Objective | S | The Aim: Transform the company into a data-driven, personalised, and digitalised enterprise, leading to value-based healthcare.<br>Objective: Build the fundamental and transformational capabilities to stimulate insights across the corporation:<br>Focus on providing technologies and platforms that:<br>1. Support seamless information sharing. information flow through an enterprise lens-across all functions.<br>2. Develop digital capabilities. Help people develop relevant skills. | The Aim: Transform the company into data-driven, personalised, and digitalised enterprise, that leads to value-based healthcare.<br>Objective: Build the fundamental and transformational capabilities to stimulate insights across the corporation:<br>Focus on providing technologies and platforms that:<br>3. Support seamless information sharing. Information flow through an enterprise lens-across all functions.<br>4. Develop the digital capabilities. Help people develop relevant skills. |

| | | | |
|---|---|---|---|
| The Project Aim/Objective | D | The main Aim: Identify opportunities for Big Data within the business and to pioneer a new way of working by utilising this new resource.<br>Objectives:<br>1. Pioneer a new mind-set with how data management and technology come together to impact and inform various ways of working.<br>2. Launch a number of different communication, education, and collaborative communities of practice to help increase knowledge of Big Data initiatives.<br>3. Build the foundation capability, resulting in incremental operational efficiencies | The main Aim: Evangelise what the Global site had already achieved and help the company learn how to embed Big Data into their functions/franchises and day-to-day work in order to operate in a new digital world.<br>Objectives:<br>1. Exploring (sense and size) Big Data opportunities as well as spreading knowledge about the *Synapse* platform.<br>2. Gain insights from the global project about the Big Data initiatives and make *Synapse* platform visible to different functions. Establishing new foundational capability.<br>3. Communicate the clarity of objectives, to convince each of the country's (the company's franchises) authorities to accommodate new processes to ensure that the *Synapse* platform was adopted. |
| The Project/s size and individuals involved in the project | D | 10 individuals across the headquarters of the company, along with a few members form External Partners team. | 20 individuals across 7,500 global individuals. The EMEA project was led by a group of people from different franchises/functions and different countries. |
| The Project Timeline | D | The project at the Global site. The project initially started in 2015 | The project at the EMEA site started after the *Synapse* platform was implemented and went live approximately Jun 2017 |
| Big Data objectives/value | S | • Improve operational effectiveness and deliver value to the organisation<br>• New business development<br>• Improve and extend customer relationships, generate new business opportunities<br>• Time and cost efficiency<br>• Improve and extend customer relationships, generate new business opportunities, and speed up and cheapen the whole cycle. | • Improve organisational operational effectiveness and deliver value to the organisation<br>• New business development<br>• Improve and extend customer relationships, generate new business opportunities<br>• Time and cost efficiency<br>• Improve and extend customer relationships, generate new business opportunities and speed up and cheapen the whole cycle. |

| | | | |
|---|---|---|---|
| Project Related Challenges | | | |
| *1.Cultural transformation* | S | Develop data driven culture. | Develop data-driven culture. |
| *2.Data Access, Governance, Policy, Law.* | D | Free access to the patients' data. The US allows access to claims data, (almost public information). They have access to a risk management program's data. | In Europe, data is more commercialised due to different data governance laws and ownerships. This results in limited access or extremely high cost of data.<br>Many limitations around:<br>• Data protection and anonymization.<br>• Legal issues<br>• lack of data privacy laws |
| *3.Technology and Capabilities* | S | • Operating capabilities<br>• System integration<br>• Reconfiguration<br>• Silo approach | • Operating capabilities<br>• System integration<br>• Reconfiguration<br>• Silo approach |
| Activities/Abilities and Practices/Processes | | | |
| *1.Management activities and practices:* | D | -Understand the power of the new resource and processes in order to align changes.<br>• Value estimation.<br>• The fundamental objectives<br>• Develop strategies for how to realise the value from Big Data<br>• Organisational alignment | -Understand the power of the new resource and processes in order to-align changes.<br>• Inward work, getting advice to implement opportunities & reorganise the EMEA.<br>• Engaged with the broader policy stakeholders, public institutions, legislators, European commission and others. |
| *Sense, Seize, and Learning practices* | D | Developing Big Data vision and data-driven culture.<br>• Communication & engagement.<br>• Workshops and practices:<br>-The immersion/experience practice.<br>-Real-time updates through dashboards.<br>-Systematic analysis and search for new solutions.<br>-Holding ad hot discussions and meetings.<br>-Set up a community of practice.<br>-Use case analysis. | -Developing Big Data vision and data-driven culture<br>• Increase awareness of *Synapse* and new capabilities.<br>• Build trust and commitment.<br>• Sensing and seizing<br>• Communication and engagement<br>• Provide real-time updates of the status of the development through dashboards |

| | | | |
|---|---|---|---|
| 2.Organisational activities / processes | | | |
| *1. Learning* | D | -Gaining knowledge about Big Data opportunities (Sense and seize)<br>• Mind mapping,<br>• Discovery, hands on experience,<br>• Ad-hot sessions,<br>• Individual insight or senior management incentive and cross-functional communication<br><br>-Knowledge creation, activities:<br><br>-Partnering with external experts in the filed for re-establishing required processes and capabilities. | -Gaining knowledge about Big Data opportunities and New capabilities.<br>• New Technology,<br>• Skill acquisition.<br>• Structure and governance.<br>• Knowledge creation, activities: repetition, experimentation, analysis of small mistakes. |
| 3.Transformation process: Reconfiguration & Coordination | D | -Knowledge acquisition, and dissemination.<br>-Networking and partnership:<br>-Determine the different internal work streams.<br>- Cultivate a community of new expertise<br>-Knowledge codification and dissemination (e. g. EMEA project's activities). | -Implementing new elements/capabilities corporation level (*Synapse* platform, Data harmonization) reinforced configuration and coordination of existing resource and capabilities.<br>-Technological transformation changed the way business was done but not the business itself and it provided a building block enabling grow. |
| New Capabilities | S | • A cloud-based analytic environment<br>• Big Data service catalogue.<br>• Big Data connectivity platform, Synapse.<br>• The patient 360 degree view.<br>• Data harmonization<br>-data governance,<br>-data standards<br>-data privacy and security<br>• Data-driven decision making | • A cloud-based analytic environment<br>• Big Data service catalogue.<br>• Big Data connectivity platform, *Synapse*.<br>• The 360 degree patient view<br>• Data harmonization<br>-data governance,<br>-data standards<br>-data privacy and security<br>• Data-driven decision making |

*Table 5.15: The Main Similarities and Differences Between Two Projects' Processes and Activities. (Author's own)*

***-The company's Big Data Initiative's Aim/ Objective***

The overall aim of the company's Big Data initiatives was to build those operational capabilities that are needed for the corporation to be able to start operating in the new data environment. In particular the aim was to be able connect with and create insights around the company's patients, in a world where the availability of different data sources and the potential of different analytic techniques means that business can be conducted faster and more cost-effectively. The decision to implement Big Data initiatives at the case study company was taken in early 2015 and was made by the company's CEO. This was supported by the senior leadership of the company and resulted in development of objectives, which were to build the fundamental and transformational capabilities for Big Data initiatives and to stimulate insights across the corporation. Senior leadership played an important role in developing the US-based Global project for the implementation of Big Data initiatives. In its own turn, the EMEA project emerged later, with a mission to roll out the innovations and technology that had been developed at the Global site. This led to awareness of the company's ability and willingness to exploit the new asset (Big Data) to develop required capabilities.

- ***The Projects (Global & EMEA) Aim/Objective***

The overarching aim for both projects was to transform the company to a more data-driven, personalised, and digitalised enterprise, and so lead to value-based healthcare. However, the difference in the detailed aims and objectives for each project resulted in differences between the organisational and managerial processes discussed in the previous sections. As was mentioned earlier, the IKU/ Big Data initiatives at the company's headquarters (Global/US) initially started around 2015, where the project was originally planned and delivered. The main aim of the project was to identify opportunities for Big Data within the business and to pioneer a new way of working by utilising this new resource. Accordingly, the project objectives were: to identify potentially valuable synergies and opportunities, to create solutions for Big Data initiatives on an enterprise-wide scale, and to build the foundation capability. Considerable attention was given to pioneering a new mind-set regarding how data management and technology can come together to impact and inform various ways of working.

In EMEA, at the time the interviews were conducted (July 2017), the project had only been running for approximately a year. Therefore, the IKU project in the Global/US was more advanced in terms of time, awareness, and progress. However, besides the timeline there were several factors which are important to highlight – for one, the aim and objectives of the EMEA project were to evangelise the achievements of the Global site and help the company learn how to embed Big Data into their functions/franchises and day-to-day work in order to operate in a new digital world. Along with exploring (sensing and seizing) Big Data opportunities for each function and franchise, the EMEA project's objectives were to gain insights from the Global project about Big Data initiatives, to make the *Synapse* platform visible to different functions, and to establish new foundational capability. A great deal of priority was attached to communicating the clarity of objectives, to convince each of the country's (the company's franchises) authorities to accommodate new processes to ensure that the *Synapse* platform was widely adopted.

To help ensure the success of the transformation, the EMEA project included a number of slightly different dynamic capabilities, such as: learning (knowledge integration and dissemination), reconfiguration, and collaborative communities of practice. The intention was to gain insights from the Global project about Big Data initiatives and to make the *Synapse* platform visible to different functions/franchises, in particular by focusing on the European sites, to help the company learn how to embed Big Data into their functions/franchises and day-to-day work in order to operate in the new digital world. On the other hand, the Global project was the company's first attempt at identifying opportunities for Big Data within the business and of pioneering a new way of working by utilising this new resource and develop fundamental capabilities.

- ***Big Data Objectives/ Value for the Business***

The overarching aim for both projects were to transform the company to more data-driven, personalised, and digitalised enterprise and so lead to value-based healthcare. In particular, the aim was to improve:

- organisational operational effectiveness and deliver value to the organisation
- customer relationships, generate new business opportunities
- time to market and cost efficiency.

- ***Challenges***

The data suggested that the main challenges for both sites during this journey related to the internal processes such as: organisational alignment to strategic choices, cultural transformation, and right skill-set (capabilities). With the corporation size, and the country boundary factors dealing with the multinational culture reflected the problems.

Two types of issue that posed particular challenges to the development of new processes were:

I. Technical issues: the technical ability and management of Big Data.
II. Management issues: organisational alignment, cultural transformation, and the right skill-set (capabilities).

An innovative spirit, based on both company values and flexibility, was found to be a positive driver for both projects. However, the challenge of developing a data-driven culture was common to both sites. Breaking down the traditional silo approach in order to gain operational efficiencies, and changing peoples' mind-set regarding the data silo approach, was the biggest ongoing challenge for cultural transformation.

However, besides a data-driven culture, there were a few factors such as data governance, data regulation, and European data policy law that the project members highlighted as having slowed down the project at EMEA. As discussed in section 5.2, the FDA and other regulatory authorities were promoting Big Data initiatives in the USA. On the other hand, in Europe, participants were hoping that the economic and social pressure that were the results of increasing digitalisation, globalisation, and differentiation of data in healthcare ecosystem would prompt changes in the laws surrounding data governance and data policy. Consequently, the IKU/Big Data project was also more advanced in the Global site in terms of data partnerships and governance. Moreover, fitting the company's overall Big Data utilisation strategy into each European country was an ongoing challenge to the company.

***-Sense, Seize***

The sense, seize, and learning processes have helped the company to reconfigure its operational capabilities, which had a major role to play in identifying, moderating/enhancing, or developing new capabilities for Big Data at every phase of the project. The specific practices of senior management, such as immersive practices at both sites, helped to increase the trust in Big Data initiatives of employees when new resources and processes were introduced within the organisation. In addition, senior management had an important role in innovating, orchestrating, and also participating in the capabilities development process by providing directions and guidance in ways that involved the whole organisation. In ways that that involved the whole organisation, while on-the-job learning and the insightful development of new processes played a large part in the successful adoption of Big Data initiatives.

Sense, seize, and reconfiguration activities were more intensive (prevalent) at the Global site. Drawing on their sensing and seizing capabilities at the preparation stage, the company was able to understand the power of the new resource (Big Data) and the processes required to implement changes. Project members were able to develop fundamental objectives and strategies for realising value from Big Data and, just as importantly, they were able to align the organisation to the expected changes, also demonstrating their coordination capabilities.

Once the background work had been completed at the Global site, and fundamental capabilities had been implemented, the sensing and seizing capabilities at the EMEA site were used more for educative purposes. In particular, the sensing capability was used to gather new knowledge in order to fully understand Big Data opportunities and the need for change.

- ***Learning and Coordination***

Learning activities and processes at the Global site enabled the reconfiguration of existing operational IT capabilities. At the EMEA site, however, learning activities and processes supported the continuous improvement of the overall project. Having the ability to generate, disseminate, and respond to Big Data opportunities (sensing and seizing capabilities), the company was able to introduce new methods of managing data. One of the results of this was a new way of managing patients' data that positively affected the way in which the company developed its products and served its patients. According to participants, with this stream-lined approach to data management the company was able to improve operational effectiveness (IT and marketing capabilities) and reduce costs. With help from networking, the company was able to more quickly generate new knowledge (learning capabilities) about new resources and technological breakthroughs and to reconfigure existing and build technologically sophisticated new technical capabilities (a cloud-based platform, data harmonization capability). Reconfiguration activities, supported by knowledge articulated from networking and partnerships, were used at the Global site to achieve evolutionary fitness (Teece, 2007) in the new digital/Big Data environment, while the coordinating capability helped implement and deploy the reconfigured operational capabilities at the EMEA site.

## 5.5 Summary of Overall Findings. Model of Organisational Practices in Big Data Adoption and in the Development of Required Capabilities.

From the finding's frameworks (Fig 5.2 and 5. 3) that were presented in sections 5.2 and 5.3, and from table 5.15 (The Main Similarities and Differences Between the Two Projects' Processes and Activities in section 5.4), it can be concluded that in a digital environment where technological innovation requires fast organisational response and change, dynamic capabilities such as strategic competitive response, learning, reconfiguration, and coordination become tools that allow firms to build and renew operational capabilities.

Figure 5. 4 below merges figures 5.2 and 5.3 into a representation of organisational practices in Big Data adoption and in the development of required capabilities. In particular the model is derived from the research findings discussed above and the literature-based conceptual framework that was developed earlier in this study (See Chapter 3).

This framework classifies the overall process, for analytical purposes, into processes and underlying managerial and organisational activities that were common for both projects and confirms the important role played by dynamic capabilities in the development of capabilities for Big Data. In the next chapter the model is compared with the current literature (see Chapter 6) and extends it by providing evidence based reasoning about Big Data capabilities development processes.

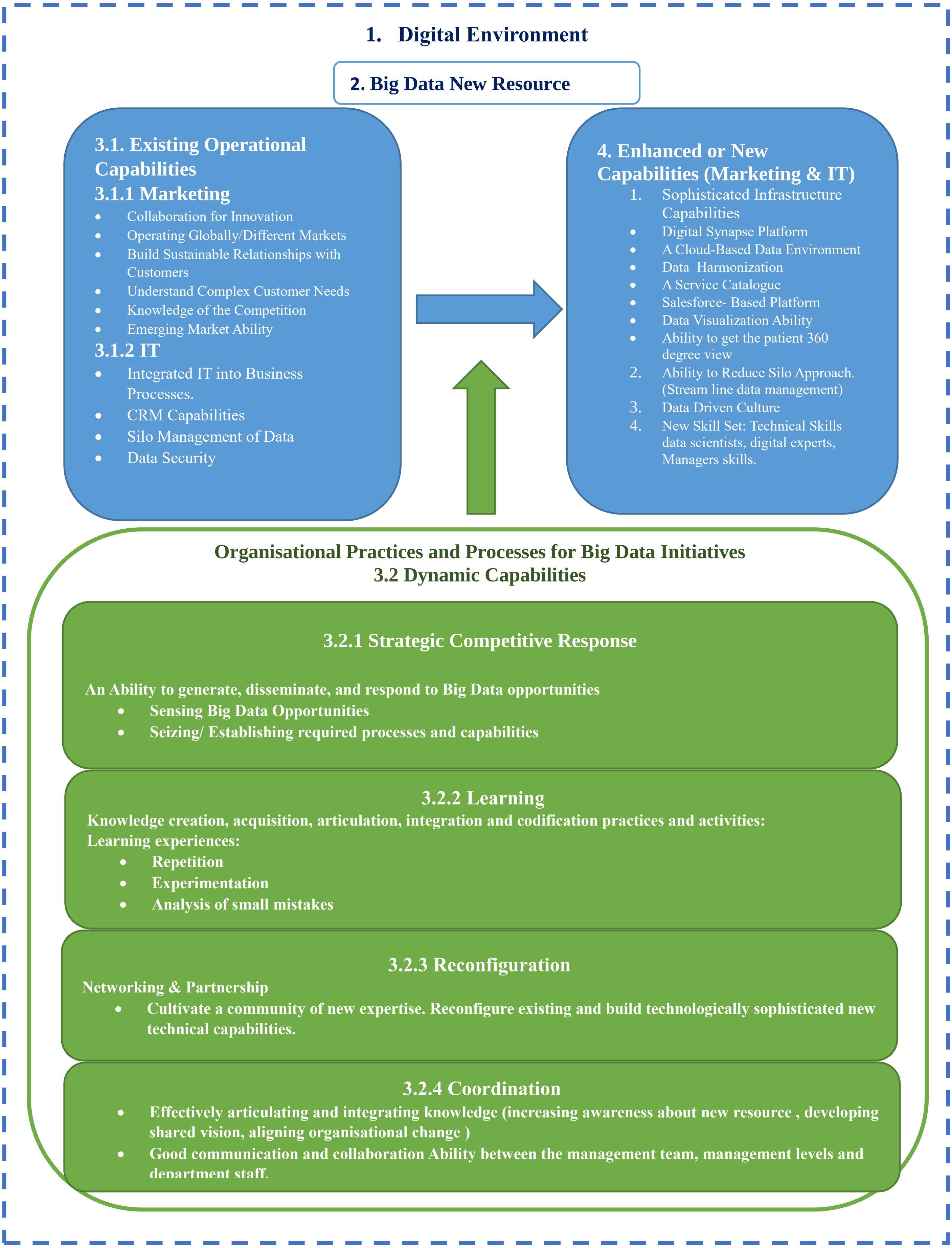

1. Digital Environment
2. Big Data New Resource
3.1. Existing Operational Capabilities
3.1.1 Marketing
Collaboration for Innovation
Operating Globally/Different Markets
Build Sustainable Relationships with Customers
Understand Complex Customer Needs
Knowledge of the Competition
Emerging Market Ability
3.1.2 IT
Integrated IT into Business Processes.
CRM Capabilities
Silo Management of Data
Data Security
4. Enhanced or New Capabilities (Marketing & IT)
1. Sophisticated Infrastructure Capabilities
Digital Synapse Platform
A Cloud-Based Data Environment
Data Harmonization
A Service Catalogue
Salesforce- Based Platform
Data Visualization Ability
Ability to get the patient 360 degree view
2. Ability to Reduce Silo Approach. (Stream line data management)
3. Data Driven Culture
4. New Skill Set: Technical Skills data scientists, digital experts, Managers skills.
Organisational Practices and Processes for Big Data Initiatives
3.2 Dynamic Capabilities
3.2.1 Strategic Competitive Response
An Ability to generate, disseminate, and respond to Big Data opportunities
Sensing Big Data Opportunities
Seizing/ Establishing required processes and capabilities
3.2.2 Learning
Knowledge creation, acquisition, articulation, integration and codification practices and activities:
Learning experiences:
Repetition
Experimentation
Analysis of small mistakes
3.2.3 Reconfiguration
Networking & Partnership
Cultivate a community of new expertise. Reconfigure existing and build technologically sophisticated new technical capabilities.
3.2.4 Coordination
Effectively articulating and integrating knowledge (increasing awareness about new resource , developing shared vision, aligning organisational change )
Good communication and collaboration Ability between the management team, management levels and department staff.

*Figure 5.4: The Model of Organisational Practices in Big Data Adoption and Required Capabilities Deployment (Author's own)*

Even though, as was discussed in the previous section, some differences existed in how dynamic capabilities were put to use between the projects, it was evidenced that the company gradually used dynamic capabilities (Box 3.2) that were embedded in the company's organisational processes. By using these abilities the organisation modified the company's resource and capabilities configuration and influenced the development of new capabilities (Box 4) for Big Data. In response to changes in the digital environment (Box 1) for the adoption of Big Data (Box 2), managerial and organisational abilities such as: strategic competitive response (Box 3.2.1), learning (3.2.2), reconfiguration (3.2.3), and coordination (3.2.4) guided the overall Big Data innovation process in the company. Together they played a major role in identifying, moderating/enhancing, or developing new capabilities at every stage of the Big Data project. While the digital environment served as an enabler for the Big Data initiative, the company's internal competencies and capabilities (IT, Marketing) had a major influence in successfully moving the overall project forward. However, it was also found that the nature of Big Data required a certain amount of reconfiguration, and the further development of such capabilities. The data indicated that the preparation process for Big Data initiatives in the case-study company overall was triggered by the company's strategic competitive response ability (Box 3.2.1), which allowed it to first sense the opportunities, an then to seize the opportunity that enabled the company to identify capabilities gaps (silo approach, connectivity, data management skills), and finally to determine a need for the reconfiguration of existing resources and capabilities. It was also evident that specific learning practices and abilities (Box 3.2.2) triggered capabilities development and guided the overall Big Data adaption process at the case-study company. The empirical evidence illustrates how purposeful learning practices and decision at the top management level in both teams influenced the development of Big Data required capabilities in a way that would be unlikely to have happened without those abilities, support, and practices. As expressed in the above sections, the development of a shared vision of Big Data and the learning processes (Box 3.2.2) which would become integrated into the corporate culture is believed to have had a transformative effect on the company.

In addition, the ability to coordinate (Box 3.2.4) different functions and franchises (Marketing, IT, policy, different countries) was also necessary for progress to made in Big Data initiatives. The implementation of new capabilities such as the Cloud-based environment, the data service catalogue, and the Synapse platform was followed by the introduction of new elements such as a stream-lined data management approach, and improved coordination. The new data connectivity platform Synapse and the Cloud-based digital environment had a significant operational impact, such as: a reduction in the "silo" approach to moving and processing data (data management), improved storage ability, improved data accountability, and data harmonisation (data governance). A service catalogue reduced the duplication of data, which consequently reduced the cost of acquiring and managing data. Thus, building these foundational capabilities allowed incremental operational efficiencies to be developed. Most importantly, the company was able to arrive at a 360-degree view of customers, which helped improve customer relationships. These new capabilities enabled the company to realise the value of data across the organisation and helped to increase the entire organisation's acumen concerning data and analytics.

## 5.6 Chapter Summary

The chapter presented findings based on an empirical data/ study. The findings are presented in two parts based on the Global (US) and EMEA (Europe) sites of the company while each was preparing for the adoption of a Big Data initiative. Section 5.2 presented the analyses of the company's Global site in its preparation for the innovation, including discussions about the processes that were introduced and examined. The findings from the EMEA site are presented in section 5.3. Section 5.4 then evaluates differences between the two and summarises the findings chapter. The findings for both sites are synthesized and discussed next in Chapter 6.

# Chapter 6: Discussion and Implications

## 6.1 Introduction

This chapter draws on the findings from Chapter 5 and cross-references with the literature discussed in Chapter 2. In addition, the findings are fully expanded and elaborated by reviewing and analysing additional literature around domains related to the study (Big Data, required capabilities, and dynamic capabilities). The aim of this chapter is to discuss the findings and determine the extent to which the research questions of the study have been answered.

The chapter starts by presenting a short reminder of the research problem and the aims and objectives of the research (6.2), followed by discussion of how the research objectives were met in relation to the research findings (6.3). It continues with a summary that emphasises the contribution that this research represents (6.4).

The main research questions that underpinned the study were:

1. **Why did an MNC in the pharmaceutical industry prepare for Big Data adoption? (RQ1)**

And

2. **How did the company approach the issue of using Big Data and how did they identify and develop their capabilities for Big Data? (RQ2)**

    I. **What new capabilities did they develop?**

    II. **How did they develop these new capabilities?**

## 6.2 Overview of the Research Problem Aim and Objectives

Motivated by increased academic and practical/managerial interest, as well as by the increasing importance of the Big Data phenomena, this research aimed to identify how Big Data initiatives are currently managed and implemented for driving innovation in the pharmaceutical industry. While considerable effort has been made to take into account the importance of Big Data as a new strategic resource (Davenport, 2012) and highlighting the open-ended potential of this new resource (Boyd and Crawford, 2012; Davenport, 2012; Chen et al., 2012) that can be explored in a variety of ways (Wamba, 2017; Mikalef et al., 2017), so far, little is known about the processes and structures necessary to orchestrate this new resource into a firm's existing resources and capabilities. In other words, the main focus of the current literature is on the resource-picking aspect (Makadok, 2001) of Big Data, but less is known about the activities required in order to develop the capabilities required to leverage this new resource strategically (Wang et al., 2012). Thus, a lack of understanding of the capabilities development process for Big Data is seen as one of the biggest barriers to the adoption of Big Data initiatives (Mikalef et al., 2017).

This study looked at the company's operational and dynamic capabilities, which together constitute organisational capabilities (Helfat and Peteraf, 2003; Teece, et al., 1997). Organisational capabilities are necessary for business transformation in the case of Big Data initiatives, so investigating what capabilities exist, how they are deployed, and the process by which they are upgraded to meet the demands of Big Data was fundamental to this study. The purpose of this study was to contribute to the current understanding of how Big Data initiatives and required capabilities come about in an MNC in the pharmaceutical industry. The main academic objectives therefore were to explore the adoption of Big Data initiatives and the practices and processes that supported the development of required capabilities in the pharmaceutical company. Thus, the intention of this thesis was to develop a step-by-step foundation of understanding and to shed light on the capabilities development process for Big Data initiatives, including how the company prepared for and utilised this resource. The findings are presented and discussed in this chapter in relation to the research objectives and the research questions. It should be noted that in the interests of grouping related themes and maintaining flow in this chapter, the second sub-question of RQ2: How did the company develop these new capabilities? is actually discussed *before* the first sub-question of RQ2: What new capabilities did the company develop?

The main contribution of this study is identified as the model of organisational practices in Big Data adoption and in the development of required capabilities discussed in previous section (Figure 5.4). As mentioned before the model was derived from the research findings and the literature-based conceptual framework (See Chapter 3) that was developed earlier in this study.

## 2. Digital Environment

### 2. Big Data New Resource

### 3.1. Existing Operational Capabilities

#### 3.1.1 Marketing

- Collaboration for Innovation
- Operating Globally/Different Markets
- Build Sustainable Relationships with Customers
- Understand Complex Customer Needs
- Knowledge of the Competition
- Emerging Market Ability

#### 3.1.2 IT

- Integrated IT into Business Processes.
- CRM Capabilities
- Silo Management of Data
- Data Security

### 4. Enhanced or New Capabilities (Marketing & IT)

5. Sophisticated Infrastructure Capabilities
   - Digital Synapse Platform
   - A Cloud-Based Data Environment
   - Data Harmonization
   - A Service Catalogue
   - Salesforce- Based Platform
   - Data Visualization Ability
   - Ability to get the patient 360 degree view
6. Ability to Reduce Silo Approach. (Stream line data management)
7. Data Driven Culture
8. New Skill Set: Technical Skills data scientists, digital experts, Managers skills.

### Organisational Practices and Processes for Big Data Initiatives
### 3.2 Dynamic Capabilities

#### 3.2.1 Strategic Competitive Response

**An Ability to generate, disseminate, and respond to Big Data opportunities**

- **Sensing Big Data Opportunities**
- **Seizing/ Establishing required processes and capabilities**

#### 3.2.2 Learning

**Knowledge creation, acquisition, articulation, integration and codification practices and activities:**
**Learning experiences:**

- **Repetition**
- **Experimentation**
- **Analysis of small mistakes**

#### 3.2.3 Reconfiguration

**Networking & Partnership**

- **Cultivate a community of new expertise. Reconfigure existing and build technologically sophisticated new technical capabilities.**

#### 3.2.4 Coordination

- **Effectively articulating and integrating knowledge (increasing awareness about new resource , developing shared vision, aligning organisational change )**
- **Good communication and collaboration Ability between the management team, management levels and department staff.**

*Figure 6.1: The Model of Organisational Practices in Big Data Adoption and Required Capabilities Deployment (Author's own)*

## 6.3 Findings, Discussions and Implications

The main findings in relation to the first research question and the model can be summarised as follows:

**RQ1. Why did an MNC in the pharmaceutical industry prepare for Big Data adoption?**

The first objective of this study in relation to RQ1 was to investigate and explore changes in the environment and processes which persuaded the company to start a Big Data initiative.

This research has found that the major influential factors the company considered in the adoption of Big Data were:

I. Understanding of the digital environment in which the company expected to be operating in a few years' time. The Big Data initiatives project at the case study company was triggered by the need to adapt to the dynamics of a new digital environment

II. The value that the company assumed could be obtained from the new resource (Big Data)

III. The crucial support of senior managers in coordinating the deployment of the new resource, as well as in innovating, orchestrating, and participating in the capabilities development process by providing direction and guidance through specific innovative practices, such as immersion/experience practices.

### *6.3.1 Digital Environment*

The development of a Big Data initiative and associated strategies at the case study company was largely influenced by the understanding of the digital environment in which the company expected to be operating in a few years' time. The Big Data initiatives project at the case-study company was triggered by the need to adapt to the dynamics of a new digital environment

(Gupta and George 2016). The ways in which this digital environment could be said to be dynamic rest on the *rate of change* in technology (Chen et al., 2012) and the amount of industrial innovation this causes (Li and Liu, 2014), as well as consequent uncertainty about actions that could be taken by competitors and customers (Wilden et al., 2013). Arguably, sensing and responding to the newly-arising opportunities has been acknowledged (Setia et al., 2018) as one of the important activities needed to achieve evolutionary fitness in the digital business environment (Teece, 2018). However, it was also important to evaluate various options to accommodate the identified opportunities within the company. The first step in achieving this goal was to develop knowledge about the new resource of Big Data and to identify required capabilities.

Prior to the implementation of new Big Data initiatives, the company's strategic choices existed in the forms of intentions, open-minded leadership, and individual and collective minds (Mintzberg and Waters, 1985). Intentions were not necessarily well-defined before their realisation, but they directed future choices and actions, influenced by different internal and external factors. For example, it was evidenced that factors entering from the external environment (Belliveau et al., 2002; Helfat et al., 2007) such as economic pressure, the FDA, and some of the regulatory authorities that had started to promote and embrace Big Data initiatives, offering solutions, consultancy and/or data-driven transformation, enabled the company to discover new ideas and direct the innovative initiatives. In particular, the recognised advances and trends happening in the new digital environment, such as digital health, personalised medicine, and value reimbursement were all influencing the new initiatives and the adoption of Big Data in the case-study company.

The development of Big Data initiatives was also based on the intentions of the company's senior management (Makalef et al., 2017), which served as the foundations of the company's strategic goal and as the basis of the actions that it took in response to the new opportunities offered by Big Data as a new resource and source of economic value (Galunic and Rodan, 1998). However, as success is not simply a question of making an accounting profit, to be deemed successful a new activity must turn out to have been a better use of the firm's resources than any alternative use (Penrose, 1959, p.178). This means that the Big Data initiatives have to reflect the strategic decisions and long-term vision (Palem, 2014) of engaging with Big Data activities, which depends on prior learning experiences, which in turn depends on sensing and seizing Big Data opportunities. A Big Data adoption project must satisfy the company's pre-established objectives as well as make better use of the organisation's resources. These efforts include technology acquisition (Wamba, 2017), resource development (Gupta and George, 2014) redesign of existing processes, (Garmaki, et al., 2016) and learning (Tecee, 2007). However, first of all, there is a need to understand what the expectations are regarding Big Data, and what the company has to do to achieve it (Gandomi and Haider, 2015). In other words, the question of what values of Big Data are fundamental for such initiatives for the company should be addressed before implementation begins.

### *6.3.2 The Value Estimation for the New Resource (Big Data).*

The findings of this study indicate that a Big Data initiative was also strongly influenced by the way in which senior managers understood the role of Big Data, and the level of strategic relevance that this new resource was believed to have. The strategic thinkers at the case-study company clearly felt the need to clarify the value of Big Data, and the extent to which Big Data was expected to generate economically valuable insights for the company (Wamba et al., 2015) before implementation. This allowed specific measurable targets to be set for given initiatives, and by doing so it was possible to evaluate and determine the effectiveness of a chosen approach. This finding is in line with Braganza et al (2017), who argue that for Big Data to be considered a truly strategic resource, senior leaders need a process that can be implemented to ensure that expected benefits are delivered from investments made in organisational resources for Big Data. It's possible that such an approach would also reduce the probability of failure in Big Data projects. As indicated in previous studies (McAfee and Brynolfsson, 2012; Gandomi et al., 2014), the reason behind the failure of some other Big Data initiatives was that executives often simply did not understand which values of Big Data were fundamental to the success of their businesses, and were not aware of how much it would cost or how long it would take to implement this new resource. Consequently, it is hard to predict the benefits company can have from such initiatives. Regarding capability development for such initiatives, similar firms with the same level of competencies may develop it in different ways, since their priorities regarding Big Data may be different, and their capability development might be contingent upon a range of internal and external factors (Mikalef et al., 2017).

### *6.3.3 Senior Managers' Support*

Lack of managerial support is also cited as a critical factor affecting the success of Big Data initiatives (LaValle et al., 2014). Arguably, managers should have the ability to understand the current and predict the future needs of different business units, customers, and other partners (Mata et al., 1995). However, open-minded leadership capable of anticipating the need for leveraging Big Data despite other competing internal priorities had a direct impact on the drive to begin Big Data initiatives at the case-study company. Senior managerial activities in support of the deployment of Big Data initiatives, based on their perceptions, abilities, and choices (Teece, 2007; Ambrosini et al., 2009), had a profound impact on how Big Data capabilities were identified and developed in the case-study company. Furthermore, senior management support and activities had a positive influence not only at the preparation stage of the adoption of new initiatives, it also reduced resistance to change (in this sense meaning for the firm to become culturally more data-driven) (Duan et al., 2012) at the implementation and transformation stages of Big Data initiatives. In addition, such was important because senior management could identify the value that Big Data would bring to the company, and had the authority to ensure that resources were allocated as necessary in support of the adoption of Big Data (Braganza et al., 2017).

The objective of the Big Data project in the case-study company was to transform the company into a data-driven, personalised, and digitalised enterprise, ultimately leading to value-based healthcare. As a further incentive, a number of synergies and opportunities were identified during the preparation stage. Understanding and defining the value of Big Data at the company was based on three broad sources of benefits: improvement of the organisation's operational effectiveness (McAfee and Brynjolfsson, 2012 and Chen et al., 2012); new business development (Aaltonen and Tempini, 2014) and improving time-to-market and cost efficiency (Srinivasan and Arunasalam, 2013). These factors were further defined as follows:

1. Improving the organisation's operational effectiveness and delivering value to the corporation through the generation of unique knowledge and insights, which in turn leads to the ability to make competitively advantageous decisions (Banasiewicz, 2013). Of particular value was the inclusion of real-time data in decision-making, which resulted in customer information being converted into knowledge useful to the company (McAfee and Brynjolfsson, 2012), as well as *start value-based reimbursement*, which is an outcome-driven model that focuses on quality-of-care metrics (Swan, 2013). The aim of these analyses was to understand disease outcomes and their associated risk factors in ways that would improve patient care.

2. New business development; improve and extend the management of customer relationships. Accelerate the individualisation of medical treatments and personalised medicine by achieving a 360-degree patient view (Yaqoob et al., 2016; Deloitte, 2014). Generate new business opportunities and new markets.

3. Time-to-market and cost efficiency. Speed up and cheapen the entire business operations cycle and improve its efficiency (Manogaran et al., 2017), in particular improve drug

development time and its associated time to reach the marketplace, thus reducing costs (Srinivasan and Arunasalam, 2013)

The pre-identified values listed above served as the aim and objectives for the company's Big Data initiatives, and as such influenced the process of capability identification and development. As has previously been mentioned in this thesis (Chapter 2), the value of Big Data does not arise from its being owned; it only has economic value if it is implemented effectively, deployed, and combined with existing resources and capabilities. Arguably, there is a need to develop strategies for defining and realising value from Big Data which was achieved through the sensing and seizing, learning and reconfiguration, and coordination abilities at the case-study company.

**RQ2 How did the company approach the issue of using Big Data and how did it identify and develop its capabilities for Big Data?**

- **How did the company develop capabilities for Big Data?**

The second objective of this study in relation to the second research question was to examine and explore the processes that enabled the company to adopt Big Data practices effectively. As illustrated in model 6.1, the study investigated capabilities (operational and dynamic) that are related to the successful adoption of Big Data initiatives.

The Big Data initiatives and the development of required capabilities at the company were guided by the set of managerial and organisational activities and processes that reflected the evolutionary process (i.e. gradual development) of learning in which the company engaged throughout the Big Data adoption projects. In particular, the findings with regards to the second research question can be summarised as follows:

1. The major influential factors in determining and developing Big Data capabilities were:

I. The processes of sensing and seizing that allowed the company to understand the new resource (Big Data) and to develop key objectives for realising value from this new resource:

Interaction between multiple factors, such as partnerships, and networking, enabled the company to intensify its sensing and seizing abilities to fine-tune the Big Data initiatives and to formulate responses/reconfiguration subsequently, which in turn also helped to develop new capabilities. The major fundamental capabilities in the case-study company at the preparation stage were developed based on knowledge acquired from networking and partnerships.

II. The processes involving learning experiences, including repetition, experimentation, and analysis of small mistakes that manifested managerial and organisational practices that have helped to identify an opportunity or need for change as well as formulating a response to it.

III. The transformation processes, where reconfiguration and coordination activities enabled the company to deliver the Big Data initiative.

2. Two key challenges were:

I. Technical issues - the technical ability and management of Big Data.

II. Management issues: organisational alignment, cultural transformation, and suitable skill-sets.

- The organisation's cultural transformation was central to the Big Data-related changes that needed to be made in the company and had a vital role in the adaption and/or development of its capabilities.

- Achieving a corporate culture that supports Big Data requires changing the mind-set of the people, which itself is influenced by the existing culture. Development of a Big Data culture is an incremental process, and recognition of the need to enhance or develop new capabilities for this new resource emerges as a result of this gradual process.

### *6.3.4 The Processes of Sensing and Seizing*

Findings show that the process of preparing for Big Data initiatives in the case-study company was triggered by sensing the opportunities, followed by the development of an initial idea of how to seize the opportunity or respond to the need to adapt, and the subsequent implementation of this idea. Sensing a Big Data opportunity, or sensing the need to change, as well as formulating a response, all required sophisticated approaches for discovering and exploiting new business opportunities (Mikalef et al., 2017). Therefore, the ability of senior management to accurately sense changes in the competitive environment (Teece, 2007), including potential shifts in technology (Wamba, 2016), competition, customers, and regulations (Hirt and Willmott, 2014) was equally important for both projects. Although the findings showed that the sensing and seizing activities were slightly different in different phases, it was clear that, over all, these activities guided the Big Data initiatives and capabilities development processes. For example, it was evident that in the preparation phase, during which an opportunity or need for Big Data initiatives was identified at the company's Global site, the use of creative approaches (mind mapping, discovery, hands on experience, ad-hot sessions, individual insight, or senior management incentives) led to improved understanding of the power of the new resource. These activities also led to the identification of capability gaps (e.g. technology infrastructure, silo approach for data management, connectivity, data management skills) and to the identification of a need for existing resources and capabilities to be reconfigured. However, as this knowledge of the validity of such was not readily available, organisations engaged various strategies by which to make it widely known. In response to the lack of knowledge and experience of Big Data the company:

1. Built a small internal team at the Global site, formed by open-minded senior managers, which focused mainly on building up the fundamental capabilities for Big Data initiatives (IT infrastructure, Data governance).

2. Partnered with external experts (Global and EMEA) in the field for establishing required processes and capabilities.

3. Disseminated the knowledge that they discovered (EMEA project)

There is little doubt that it is important for a company to work out the details, skills, practices, and mind-set needed for the success of a Big Data initiative (Constantiou and Kallinikos, 2015), although it can be argued that the overall picture cannot be comprehended in its entirety. Therefore, in order to fully understand the opportunity represented by Big Data and the need for change that would result, the company considered it useful to systematically present learning experiences through the sensing and seizing activities. These included gathering new knowledge, seeking advice on how to implement opportunities, and engaging with the broader policy stakeholders, public institutions, legislators and others, were all important activities at the transformation phase and heavily influenced capability development.

While project members were primarily tasked with searching for new ideas, insights, and solutions, this undertaking also resulted in the engagement of external expert networks. It was evident that these external networks provided important complementary knowledge (Polder et al., 2010; Rehman, 2017) regarding new solutions. In particular, it was apparent that via these external networks the company acquired new knowledge regarding the technology required to handle Big Data and, by integrating that knowledge into its internal processes, was thus able to enhance and develop its existing IT capabilities. Big Data calls for novel technologies that are able to handle large amounts of diverse and fast-moving data (Gupta and George 2016). While data itself is a core resource, it is also important for a company to possess infrastructure capable of storing, sharing, and analysing data (Akter and Wamba, 2016). The company's sensing capabilities thus seemed to support the reconfiguration, and consequently the modification and/or development new IT capabilities. The major new IT capabilities required by the case study company were based on the sensing activities supplemented with the knowledge acquired from networking and partnerships. This finding complements Zhang and Wu,'s (2017) suggestion that external networks may represent an efficient and cost-effective option when the company lacks knowledge about the changing business environment. Thus, based on the evidence, the findings confirm that by engagement with the experts in the field the company was able to enhance the existing IT, seizing, and reconfiguration abilities (Teece, 2007) quickly and cheaply. The company's networking and partnership activities can be interpreted as knowledge creation, acquisition, and dissemination (Zahra and George, 2002) which, on the other hand, helped the company identify and implement new Big Data capabilities at the corporation level such as: the Cloud environment, the *Synapse* platform, and data harmonization. Implementing new capabilities reinforced the configuration and coordination of existing resources and capabilities.

Based on the empirical evidence it can be suggested that the interaction between multiple factors, such as partnerships, government support, and collaboration with different parties enabled the company to develop its own dynamic capabilities for Big Data initiatives. This is in line with the findings of Mahmood et al. (2011), which suggest that a firm's business networks also represent an important source of capability development. The study also found that to enable the potential of Big Data, companies need to coordinate and collaborate with other major Big Data actors and users. Different types of networks such as: buyers, suppliers, alliances, market-related networks, technological institutions, whether individually or in combination (Rehman, 2017), affect a company's ability to enhance or create new capability development for Big Data.

Capabilities development required the company to engage in action and to develop experiences. These experiences were archived through learning processes. As was indicated earlier, engaging with sensing and seizing activities was complemented by learning experiences. Interview respondents were clear that their capabilities were developed while they were learning about how to find new solutions and to create new knowledge, including repetition, experimentation, and the analysis of small mistakes.

### *6.3.5 The Learning Processes*

The development and evolution of capabilities are influenced by knowledge creation, codification, and integration (Wilden et al., 2015). The creation of knowledge when introducing innovation, such as new resources and technology, involves promoting and shaping the learning process to evolve existing organisational capabilities (Teece et al., 1997; Eisenhardt and Martin, 2000; Zollo and Winter, 2002; Helfast and Peteraf, 2003). However, one side of learning processes consists of the ability to reconfigure existing resources and capabilities according to changes brought about by external dynamic environmental influences (Teece, et al., 1997) and another involves improving an organisation's day-to-day processes, as well as learning how to incorporate Big Data into those processes (Gupta and George, 2016). This was evidenced in the findings of this study. The creation of visual representations of the project's key elements was also found to be a highly valued and positive activity (the immersion/experience practice). At different phases the company globally introduced several immersive activities which helped to expose and demonstrate different ways in which the Big Data ecosystem is evolving, and the significance of this to the company. Different techniques, such as 3D videos, virtual reality, or use cases were used to help people within the company to visualise and learn about Big Data opportunities. These activities and practices were particularly helpful for increasing awareness about the opportunity represented by Big Data, and to demonstrate its potential value to the company. Empirical evidence also confirmed that a "hands-on" approach enhances experience and knowledge, leading to improved understanding of the benefits and impact of this kind of innovation (Backman and Barry, 2007). Positive effects were also identified in both projects as being the result of learning efforts that tended to involve forms of systematic analysis, and the search for new solutions for the Big Data initiatives. These efforts tended to be self-reinforcing, and a gradual process of small related recognitions led to new discoveries, which led in turn to a widening scope of project members' thinking. There was therefore broad agreement at the company that it was necessary to use and make progress with Big Data in this way (Gupta and George, 2016). Thus, learning experiences were equally important and fostered the development of capabilities in both projects. In particular, learning activities and processes at the Global site enabled development and implementation of new capabilities, while learning activities at the EMEA site supported continuous improvement of the overall project. Practices such as: experimentation, cross learning, and sharing new initiatives externally and internally, risk-taking experiences, setting up a community of practice, and use case analysis were prominent throughout both projects. It was evident that in addition to fundamental capabilities that were having transformational effects on the company's operations, EMEA project members were able to improve and expand these capabilities based on knowledge that had been created through the learning processes. For example, new abilities/capabilities such as data visualisation, which was highlighted (Akter and Wamba, 2016) as one of the important capabilities for the management of Big Data, developed by the creation of a dashboard using *Tableau* at the EMEA site. This was based on new knowledge that had been acquired after the implementation of fundamental capabilities by the Global site. Essentially, the importance of the ability to visualise Big Data is that it can transform raw data into meaningful insights to improve decision-making (Wixom et al., 2011). All of these activities can be interpreted as experiential and cognitive learning, that rely on many factors, including problem-solving skills, thinking skills, and the perception of learned materials aimed at implementing a course of action with the objective of executing and putting into operation the new Big Data initiatives. This empirically-grounded evidence of efforts of learning suggest that dynamic capabilities are capabilities that can be enacted, and which are oriented towards pre-identified strategic objectives. They rely on different practices such as the sensing and seizing of opportunities, reconfiguration, and coordination. The processes underpinning them include changes to operational and tactical activities to respond to the changing environment.

### *6.3.6 The Transformation Processes: Reconfiguration and Coordination*

To benefit from sensing, seizing, and learning activities, orchestration of the company's resources and capabilities must be reconfigured to achieve better utilization of a new resource (Wilden and Gudergan, 2015). The transformational characteristic of dynamic capabilities implies that the company must possess the ability to adjust its capabilities in response to change (Teece, 2007; Wilden and Gudergan, 2015). It can be argued that the ability of a company to transform and reconfigure its resource base is itself a learned skill. It was evidenced that through experience and practice, the company was able to determine and manage new initiatives and required capabilities. Implementing new ideas and technology required the introduction of new elements and was accompanied by the reconfiguration of the existing activities and processes. The empirical investigation suggested that technological (IT) and certain marketing and connectivity capabilities were enhanced as a result of the company’s reconfiguration ability. For example, as was highlighted earlier, through networking and partnership, the company was able to determine the different internal work streams, resources, and capabilities that needed to be re-engineered to fully leverage Big Data. In particular, the company was able to cultivate a community of new expertise, both centrally and embedded in the business, where data scientists, digital experts, taxonomy experts, and business development/alliance managers helped the company to build new skillsets to embrace its expanding data, advanced analytics, and technological capabilities. These new skill-sets and expertise enabled the company to realise the value of data across the organisation and to help increase the entire organisation's acumen with respect to data and analytics. The company was able to identify, implement, and develop several technologies and techniques such as: data connectivity (Akter and Wamba, 2016;Wamba et al., 2015); data harmonisation, and visualisation (Gupta and George, 2016; Garmaki et al., 2016) which on the other hand improved the coordination of different departments in support of the transition. In particular, connectivity was found to be an important aspect in the management of different types and categories of continuously aggregated data. (Data aggregation is a type of data and information mining process where data is searched, gathered, and presented in a report-based format to achieve specific business objectives or processes and/or conduct analysis (Garmaki et al., 2016). As such, data harmonisation represented data governance (Cao and Duan, 2014), the rules and controls that users, different functions, and departments must comply with when performing relevant tasks. It was evidenced that integrating internal and external data despite resistance to the idea of merging data across the company was one of the biggest obstacles detected in the case study. These problems highlighted the need for support (mentioned earlier in this chapter) from business leaders to establish technology, norms, and standards that would facilitate more transparent data management. There is some evidence (Wamba et al., 2015; Mikalef et al., 2017) in the literature where authors stress the importance of the availability of data, as well as having the ability to integrate this data from various sources, which traditionally may be siloed due to existing IT architectures and data management abilities. However, the focus in the literature is mainly on the issues of availability of data in order to complement analytics and to gain more insight into customers and operations (Mikalef et al., 2017), rather than managing such data in a more transparent way. Arguably, the significance of the *variety* of data sources needed in order to derive meaningful insight and to direct strategic initiative (Ransbotham and Kiron 2017) is important, although one of the main characteristics of such data is to extract meaningful and valuable information from varied data sources requires sophisticated infrastructure (adequate hardware and technical software) (Garmaky et al., 2016), particularly in cases when the data will not only benefit individual departments, but become available to the entire corporation (Gupta and George, 2016).

The empirical evidence also highlighted that where capabilities are new it is important to effectively communicate changes internally and to increase awareness of the ongoing efforts, in order to promote learning and best practice. Introducing a new IT platform and related technology requires the development of new skill-sets within the organisation. Without having the correct knowledge in place and without the capabilities to utilise the new technology and exploit the vast datasets, the company's Big Data project could not have progressed into the operational stage.

### *6.3.7 Big Data Challenges*

In a good project, implementation goes beyond the technical development of the system (Dhillon, 2004). It is important to understand the power of the new resource (Big Data) and processes in order to align changes in the structure, systems, people, and culture. Arguably, the findings of this study acknowledge that some of the technical challenges, such as unsophisticated infrastructure (meaning the platform for storing and sharing data) (Morabito, 2015); data access (data coordination and harmonisation) (Wamba, 2016), and the system integration process (Garmaky et al., 2016) all have a direct impact on the utilisation of the Big Data initiative. It was evidenced that new tools and approaches are replacing entire data ecosystems – for example, the use of new statistical techniques and languages like Hadoop and R, are emerging and, as they enter the workplace in greater numbers, traditional approaches to data management and analytics are gradually being enhanced or even replaced altogether (Gupta and George 2016; Makalef et al., 2017). However, the empirical findings suggest that the vast majority of the challenges with which the company struggled at any stage of the adoption of Big Data adoption were related to people and to the company's internal managerial processes, and not to technology. This findings is in line with LaValle et al (2011), who argue that getting data and performing data analysis correctly are not the biggest obstacles in Big Data and analytics, but rather the barriers to adoption mostly relate to managerial and cultural change. The managerial challenges at the case study company concerned issues such as: understanding and extracting value from the new resource (Constantiou and Kallinikos, 2015; Gupta and George, 2016); cross-functional alignment of organisational mission, vision, goals, and technology (George et al., 2014), management of data privacy and regulation (Mikalef et al., 2017), and cultural transformation (LaValle et al., 2011; Gupta and George, 2016). Furthermore, the findings of this study highlighted the significance of a data-driven culture and the impact upon the connected operations. This is in line with Cao and Duan's (2014) and Gupta and George's (2016) findings, who also acknowledge the importance of a data-driven culture in driving the adoption of Big Data and the development of company-wide Big Data capabilities. A data-driven culture sees data and analytics as a central function for promoting a cross-functional distribution of data that allows for more fact-based decision-making (Parmar et al., 2014). Before organisations can fully employ Big Data there is a need to strengthen data acceptance, data reliance (Galbraith, 2014), and analytic capabilities (Gupta and George, 2016) within the organisation to arrive at achieve a data-driven culture. This requires the gradually introducing the importance of data-driven insights to a breadth of each departments (Gupta and George 2016). A data-driven culture also reduces siloed units, and enables a greater depth and richness of data to be analysed, while also allowing for separate organisational units to work collaboratively towards analytics-generated insights (Mikalef et al., 2017). Thus, it can be concluded that forming a culture that supports Big Data depends on changing the mind-set of the people, which itself is influenced by the existing culture. Development of a Big Data-driven culture at the case study company was an incremental process, with realisation of the need to enhance or develop capabilities for this new resource emerging from this gradual process.

Positive effects were found in the case-study company of the use of specific practices in establishing the importance of a data-driven culture (Mikalef et al. 2017). Empirical evidence highlighted the usefulness of activities such as immersion practice, real time updates through the company dashboard, and training programs on increasing awareness and demonstrating the importance of the Big Data project. In particular, according to the participants these kinds of activities had a greater impact on the company's existing data management culture (silo thinking). Furthermore, the demands of a Big Data initiative are such that the employees engage in new activities, and learn different skills. In order to achieve this level of involvement, employees have to understand in what direction they headed, and why (Rigby et al., 2002). Moreover, it was found that ability to become more data-driven required a mind-set shift across the entire company. In order to achieve a shared vision of the value and future of Big Data across the organisation, it is necessary to increase awareness of this new resource, to establish trust in the potential of the existing opportunities, and to reach shared agreement that it represents a vital direction in which the company should go. Some authors (Ryals and Knox, 2001; Rigby and Ledinghan, 2004) argue that any initiative must have the participation of all organisational members, and that it is only possible if top management "buy into" the lead initiative. The engagement of senior managers in specific activities, such as immersive practices, workshops, and extensive communication to increase awareness of the new resource (Big Data) and the development capabilities had a positive impact on the creation of a shared and culturally entrenched vision of this new resource. These processes included presenting an explanation of the new initiatives by the company's Global IKU/ Big Data project's members, followed by the EMEA project's members providing information about the new *Synapse* platform and data harmonisation ability. An important step was also to clearly communicate the objectives that the project members were hoping to achieve in an effective way, to build trust and ensure commitment from each of the country's authorities (the company's franchises) to accommodate new processes that would ensure that the new capabilities (*Synapse* platform and data harmonisation) were adopted. Ford (2003) argued that commitment is based on qualitative elements such as satisfaction and trust, and that their development depends on how the parties involved in new activities view each other's capabilities and motives, and how they interpret their own actions and those of others. This interpretation can change over time in the light of new experiences. Thus, the active involvement of senior managers in developing and implementing employee engagement programs helped to gradually develop commitment to using the new technology. This further led to an improvement in the company's ability to culturally adopt and transform in response to the new opportunities presented by Big Data.

Overall, the results show that the concept of Big Data initiatives (and the development of required capabilities) was developed through the path of dynamic capabilities, which can be seen as a mediating factor. By using its abilities, such as sense and seize ability, learning, reconfiguration, and coordination, the company became adaptable and escaped unfavourable path dependencies, thereby achieving evolutionary fitness (Teece, 2007).

- ***Explanation of the arrows on the model.***

The arrows on the model illustrate the mediating effect of dynamic capabilities between the existing IT and marketing capabilities and the new Big Data required capabilities. The findings from the case study show that dynamic capabilities such as: sense and seize ability, learning, reconfiguration, and coordination positively influence the adoption of Big Data initiatives and the development of new capabilities. In a digital environment the enforcement of dynamic capabilities was important for adoption of the new resource adoption and development of required capabilities - in particular:

I. Having an ability to generate, disseminate, and respond to Big Data opportunities (sensing and seizing capability) meant that the company was able to introduce new ways to manage data. Consequently, with a new stream-lined approach to data management, the company was able to improve operational effectiveness (IT and marketing capabilities) and reduce costs.

II. By generating new knowledge more quickly (learning capabilities) about new resources and technological breakthroughs through networking, the company was able to reconfigure existing and build sophisticated new technical capabilities (Cloud- based platform, service catalogue).

III. By effectively articulating and integrating knowledge (increasing awareness of the new resource, developing shared vision, aligning organisational change, and coordinating capabilities) the company was able to gradually shape the corporate culture and develop new data-driven capabilities.

These findings are aligned with (O'Reilly and Tushmann, 2008, p. 186; Pavlou and El Sawy, 2011; Protogerou et al., 201o; Erevelles et al., 2015) who show the positive effect of dynamic capabilities on the reconfiguration of operational capabilities to match turbulent technological environments. Pavlou and El Sawy (2011), for example, confirm the effect of dynamic capabilities on a firm's performance by showing this effect through its ability to reconfigure operational capabilities into new ones that better fit the environment. Similarly, Protogerou et al. (2010) investigated the relationship between dynamic capabilities and a firm's performance, confirming that the relationship is mediated by functional competencies. In this sense, dynamic capabilities can be understood to be the antecedent strategic processes that integrate, recombine, and generate new technological and marketing competencies which in turn shape a firm's performance. The findings of this study confirm that interaction between dynamic (sense and seize, reconfiguration, coordination, and learning) and operational (IT, Marketing) capabilities provided a strong mechanism through which the company was able to identify, modify, and/or develop new capabilities for Big Data.

- ***What new capabilities did the company develop?***

As illustrated in model fig. 6.1, through the managerial and organisational processes discussed above the company was able to identify, develop, and/or enhance capabilities for their Big Data initiatives. In particular, new capabilities such as sophisticated infrastructure (the ability of the hardware and technical software) such as the Cloud environment, the *Synapse* platform, and data harmonisation were developed by the Global project. These techniques and technologies extended the traditional solutions and/or resulted in new such being developed, enabling the processing of continuous flows of information in real-time (Wamba et al., 2015). It was evidenced that implementing the *Synapse* data connectivity platform and cloud environment had significant operational impacts such as: the ability to reduce the silo approach of moving and processing data (stream-lined data management), extending storage ability and data accountability (data governance), and reducing the duplication of data with subsequent reductions in the cost of acquiring and managing data. Implementing these new capabilities at corporation level reinforced further configuration and coordination of existing resources and capabilities, as well as developing new ones (data visualisation) by the EMEA project.

Using new analytics capabilities such as the company dashboard (for data visualisation) and the salesforce-based platform facilitated clinical information integration and provided evidence-based clinical practice. Participants explained that the new systems provide solutions to process large volumes of data, to manipulate it real-time, and to capture all patients' visual data or medical records. In doing so, this analysis offered the company greater business insights, leading to the discovery of previously unnoticed patterns in patients' related needs and future market trends. In this way the company was able to improve quality of care and financial performance.

The empirical investigation also confirms that the use and management of Big Data offers a range of different experiences. Along with the new technology and techniques required by Big Data, such initiatives also require different skills and the establishment of a data-driven culture. For example, technical skills (technical knowledge, referring to skills required to extract value or intelligence from Big Data) (Wamba et al., 2017), required further investment and recruitment (Chen et al., 2012) at the case-study company. It was evidenced that participants were talking about the need for more data scientists, digital experts, taxonomy experts, and business development/alliance managers. The managerial skills that the study found at the case-study company were business knowledge and problem-solving abilities (Gupta and George, 2016), with good communication and collaboration abilities needing to be demonstrated by the management team, management levels, and department staff in order to fully exploit the business value of Big Data initiatives. However, it must be acknowledged that this study did not investigate individual skills but rather the company’s capabilities overall.

Building a foundation of capability, such as the connectivity platform, data access, and relevant skill-sets, allowed incremental operational efficiencies to be made. Technological transformation changed the way business was done at the company and represented a building-block to further growth.

## 6. 4 Contributions

The study makes a number of contributions. First it provides an in-depth case study of big data preparation in the specific context of a MNC pharmaceutical company that is of value to both academics and practitioners (practical implications is discussed in next chapter). Second it provides a theoretically based and empirically validated model (Figure 5.4) of the development of capabilities associated with Big Data adoption. Finally, it makes a contribution to academic theory by contributing to the ongoing discussion in the academic literature of the utility of the concept of dynamic capabilities.

In particular:

1. The study provides empirical support for the underlying assumption of the role of dynamic capabilities in modifying operational capabilities (Winter, 2003; Helfat and Peteraf, 2003; O Reilly and Tushmann, 2008, p.186; Pavlou and El Sawy, 2011). In particular, analysis of the empirical data established the link between and the effect of dynamic capabilities on the adoption of Big Data initiatives and the process of developing required capabilities in the case study company. The study also used empirical research to challenge the existing literature, in which dynamic capabilities has been criticised for existing only at an abstract level, for lacking empirical grounding (Wiliamson, 1999), and for being only tautologically linked to a company's performance (Priem and Butler, 2001; Erikisson, 2013).

Although the practice of enhancing existing capabilities has been acknowledged to close gaps and improve underperforming capabilities (Lavie, 2006, Danneels, 2010), the role of dynamic capabilities in this process had received less attention in the literature. In fact, some scholars are still sceptical about the role of dynamic capabilities (Winter, 2003, Zahra et al., 2006). Thus, the findings from this study shed light on the research relating to the development of capabilities and on the research surrounding dynamic capabilities alike, by explaining the role played by dynamic capabilities in the Big Data capabilities development process.

It achieves this, in particular:

i. by showing the positive effects of the company's sense, seize, learning, and reconfiguration activities on the company's operational IT and marketing capabilities in the context of Big Data initiatives, demonstrating that it is not only reconfiguration capabilities that can act to modify existing operational capabilities. The knowledge derived from the sense and seize activities was vital to foster the development of operational capabilities at every stage of Big Data capabilities development process. This notion complements and strengthens Bruni and Verona's (2009) and Pavlou and El Sawy's (2011) findings on how market knowledge acquired from the sensing activities has sometimes been used to reorganise the product development process. In particular, Pavlou and El Sawy (2011) found that having the sensing capability to generate, disseminate, and respond to market intelligence about new products means that development units are able to develop technologically sophisticated products more quickly, by orchestrating resources tasks and activities. In the case of Big Data initiatives, knowledge from the sensing activities helped the company to reorganise data management processes and capabilities.

ii. Based on the findings, this study argues that dynamic capabilities enable and foster development of existing (market, IT) capabilities and/or new capabilities in support of Big Data initiatives. This complements the recent findings of Braganza et al. (2017), who highlight the importance of dynamic capabilities in the Big Data adaption processes, which require altering over time. This corresponds well with the assumption by Teece (2007) that dynamic capabilities are in effect the ability of an organisation to 'orchestrate' and/or govern the rate of change in its resources and ordinary capabilities in order to adapt and evolve to rapidly-changing environments. Moreover, findings from this study bring new insight based on empirical evidence, and make it clear that Big Data adoption processes require a company to change over time (Gupta and George, 2016) in ways that are self-reinforcing. As was observed in the evidence, a gradual process of small related recognitions led to new discoveries which led in turn to an increase in scope of possible subsequent activities. In response to the new resource (Big Data) and the resulting change in operational and tactical activities (Braganza et al., 2017), the company's dynamic capabilities also facilitated the development of new capabilities. Thus, this finding adds insight to the debates between different streams of the dynamic capabilities research about the role it plays in practice. Considering the current discussions about whether the role of dynamic capabilities is to change existing capabilities (Adner and Helfat, 2003; Zahra et al., 2006; Teece, 2007; Braganza et al., 2017), or to act to create new capabilities (Aragon -Correa and Sharma, 2003, p. 73) or whether it can do both, this study confirms that in the case of Big Data initiatives it is both: dynamic capabilities can integrate and build upon an organisation's current competencies, while simultaneously supporting the development of fundamentally new capabilities (Benner and Tushman, 2003, p. 238; O Reilly and Tushmann, 2008).

2. Beyond confirming that dynamic capabilities, such as strategic competitive response, reconfiguration, coordination, and learning are enablers in the creation and implementation of Big Data initiatives (Teece, 2007; Protogerou et al., 2011; Erevelles et al., 2015; Wamba, 2016), this study also identified valuable additional activities and practices such as: senior management support, networking and partnership, and cultural transformation along with how each of them were enacted.

The study also contributes to the contextual approach of the dynamic perspective, more specifically to the existing literature (Teece, et al., 1997; Zahra, et al., 2006; Tripsas and Gavetti, 2000; Adner and Helfat, 2003; Teece, 2007; Eggers and Kaplan, 2009) that relates to the role of senior management in the development of capabilities. Senior management does indeed play a vital role within the process (Braganza et al., 2017) and their abilities/skills (Gupta and George, 2016) and active participation are regarded as necessary success factors in the development of Big Data capabilities. The apparent importance of management participation is in line with the propositions of the dynamic capabilities paradigm, in which entrepreneurial managers play a vital role in identifying opportunities and need for change, in formulating responses, and in implementing courses of action (Helfat et al., 2007; Teece 2007).

- The research findings correspond to the call for more research (Teece, 2012; Eriksson, 2014) on how managers explicitly and implicitly influence the development of capabilities. The study was conducted with contributions from diverse opinions from senior managers and Big Data experts, the majority of whom had experience of the capabilities development process for the utilisation of Big Data initiatives in a global pharmaceutical company. Thus, the empirical evidence illustrated how the purposeful practices of the senior management, and the decisions made by them, influenced the development of Big Data required capabilities in ways that were unlikely to have happened in the absence of those '*managerially-amenable*' practices (Pavlou and El Sway, 2011, p. 260). Thus, the findings of this study add insight to the existing literature (Gunther et al., 2017; Braganza et al., 2017) by confirming the importance of management abilities/practices in the implementation of Big Data initiatives and in the development of required capabilities.

- By pointing out the importance of the way in which senior managers understood the value of Big Data and the level of strategic relevance that this new resource was believed to have, the study contributes to knowledge regarding the importance of the realisation of value from Big Data. From the beginning, and throughout the research, both the conceptual framework and the empirical evidence indicated that it would be incorrect to define Big Data based solely on its size and availability. Instead, it showed that it is important to consider the value of this new resource prior to implementation, particularly with reference to the company's operations and aims. These findings are in line with those of Ghoshal's et al. (2014) and Wamba et al's. (2015), whose findings indicate that what benefits organisations perceive as 'Value' depend on their strategic goals for adopting and using Big Data. The strategic thinkers at the case-study company clearly felt the need to clarify the value of Big Data, and the extent to which Big Data was expected to generate economically valuable insights for the company (Wamba et al., 2015) before implementation. This allowed specific measurable targets to be set for given initiatives, and by doing so it was possible to evaluate and determine the effectiveness of a chosen approach. In addition, it influenced the process of capability identification and development which was achieved through the sensing and seizing, learning and reconfiguration, and coordination abilities. This finding is also in line with Braganza et al. (2017), who argue that for Big Data to be considered a truly strategic resource, senior leaders need a process that can be implemented to ensure that expected benefits are delivered from investments made in organisational resources for Big Data. It can be assumed that such an approach would also reduce the probability of failure in Big Data projects. As indicated in previous studies (McAfee and Brynolfsson, 2012; Gandomi et al., 2014), the reason behind the failure of some other Big Data initiatives was that executives often simply did not understand which aspects of the value of Big Data were fundamental to the success of their businesses, and were not aware of how much it would cost or how long it would take to implement the changes required to benefit from this new resource.

- By highlighting the role of networking and partnership during Big Data initiatives, this study adds insight into the tangible means by which managers in this process can enhance their company's dynamic capabilities. This challenge Winter (2003, p. 991) who pointed out that doubt exists that deliberate efforts to strengthen dynamic capabilities are a genuine option for managers. This is mainly because Winter (2003, p. 993) believes that an intended search for such occasions can impose additional costs. The author believes that the capability must be exercised: for an organisation to possess dynamic capabilities but have no occasion to put them into effect is merely to bear an additional cost. However, in the case of a fast-moving, competitive Big Data environment that requires continuous modification and, if necessary, a complete organisational overhaul to maintain a good fit with the ecosystem in which a firm operates, there is an enhanced need for strengthening dynamic capabilities, especially when organisations need to pioneer new ways of adopting Big Data.

- This study provides empirical/practical evidence that managers who are interested in using networking and partnerships to create knowledge about a new resource assist greatly in the enhancement of dynamic capabilities. This finding complements the conventional approaches to strategy that suggest that in Big Data programmes many key roles lie outside the organisations in question (Braganza et al., 2017), and that the nature of relationships are more transitory. Interaction between multiple factors such as partnership, networking, and collaboration with different parties enhanced and strengthened the company's seizing and reconfiguration abilities at the preparation stage. Thus these activities can be interpreted as knowledge creation, acquisition, and dissemination which can be dynamically used to fine-tune Big Data initiatives and to formulate responses/transformation activities to face the challenges in the event that a firm does not have much experience or best practices to draw on.

## 6. 5 Chapter Summary

The chapter discussed the findings in relation to the research questions and determined the extent to which the research questions of the study have been answered. After presenting a short reminder of the research problem and the aims and objectives, discussion followed of how the research objectives were met in relation to research findings. The chapter also presented the contributions of the research to the existing body of knowledge and theory. Chapter 7 now summarises this study, presents the study's limitations, and articulates its implications for future research.

# Chapter 7: Conclusion and Final Remarks of the Thesis

## 7.1 Summary of the Thesis

The study adopted the RBV and the Dynamic Capabilities perspective to explore the activities and processes by which Big Data initiatives and the development of required capabilities emerge in an MNC in the pharmaceutical industry. Based on a review of the Big Data, capabilities, and dynamic capabilities literature in Chapter 2 research gaps were identified and research questions were formulated. After this, the initial conceptual framework was designed and proposed to guide the empirical stage of the study in Chapter 3. The framework was investigated using a case study methodology (Chapter 4), which included collecting and analysing data from the case-study company (a global pharmaceutical company). The findings in Chapter 5 collectively provided in-depth insight and novel understanding of how a global MNC in the pharmaceutical industry approached Big Data initiatives, how it prepared, developed, and implemented Big Data capabilities. The proposed model of *Organisational Practices in Big Data Adoption and Required Capabilities Deployment* presented in Chapter 6 not only enhances our theoretical understanding of such processes, but also offers insights into practices that will be of particular value to those at management-level and above.

## 7.2 Practical Implications

It should be noted that the practical implications laid out in this section are based on the findings from one case study, and so it must be emphasised that its observations and suggestions about how to implement Big Data initiatives and how to develop required capabilities will likely not be universally applicable. However, based on the findings of the study and the literature there are arguably not yet many standardised processes by which to manage Big Data initiatives. Consequently, organisations are recommended (Brynjolfsson et al., 2011; O' Reilly and Tushman, 2016) to actively engage with learning practices to identify and develop various capabilities for dealing with continuous changes and the other challenges introduced by this new resource. Some pioneering approaches already exist (McAfee and Brynjolfsson, 2012) but they are still in their early stages (McKinsey, 2013).

This research has implications for practitioners who are either planning to implement Big Data initiatives, or who have already started and are in the early stages of implementation. Adopting a practical/managerial viewpoint, from the findings of the investigation of the development of capabilities for Big Data initiatives the following conclusions can be drawn. First, practitioners who wish to start a Big Data initiative have to develop objectives for such an initiative. Significant time should be devoted to discovering what Big Data means to the company and identifying the path by which the objective could be archived. Great attention also should be paid to any skills gap that is identified, and consideration given to ways by which to fill this gap. The research suggests that learning and training can help solve this problem - however, this will require commitment to appropriate levels of investment, and even then it will likely still be necessary to hire skilled resources or talent from outside the company.

Based on the case-study company's example, preparation for and implementation of Big Data initiatives is a highly integrated process that happens concurrently; it incorporates learning practices, and hence engaging in action (learning experiences), which is required not only to develop the new capabilities, but also to identify transformation and operational challenges. This means that the processes for Big Data initiatives cannot be entirely pre-planned. While it is vital to provide direction by guiding the organisation and by establishing learning and transformation processes, activities, and structures, it is equally important to start building the Big Data vision of the people within the organisation as a whole. It is also essential to increase awareness of the new resource, and to build trust about the fact that the business should put it to use. Clear communication is key when discussing what could be gained from the new resource, when encouraging employees to think about how existing standards and practices can be improved, and when promoting the acceptance of new initiatives.

Based on the case study's findings, companies must take a long-term view and recognise the importance of cultural change in order to successfully adopt Big Data. Significant effort should be made to develop a data-driven culture to allow cross-functional distribution of data that allows for more data-based decision-making.

As has been outlined, different capabilities and skills are needed throughout the adoption process. While the preparation stage requires a more entrepreneurial mind-set to sense opportunities and to formulate responses to seizing them, the implementation and transformation phases are likely to require more operational (appropriate IT infrastructure) and data management (Data Harmonisation, Data Driven Culture) capabilities. Therefore, managers should be prepared to reconfigure and coordinate their teams and functions.

Although it is likely to be difficult to outline a detailed roadmap, managers should have a "big picture" in mind of which activities will be required throughout the process. Such a grand overview will provide stability and comfort to themselves and enable them to provide direction to the organisation. The model (Figure 6.1) provides an orientation of this process.

## 7.3 Research limitations

While the study offers important insights into why a Multi-national Corporation (MNC) in the pharmaceutical industry prepared for Big Data adoption and how it identified and developed capabilities for this new resource, it has several limitations.

The main limitation of this study is the sample size, the lack of intensity of the innovation of the Big Data initiatives in the case-study company, and the nature of the industry itself (with its comparatively slow business cycle) limited the opportunities to gain access. Therefore, the data access strategy was by necessity rather opportunistic. Even though the case-study company permitted access to the company's different sites (EMEA and Global), which allowed investigation of different stages of the company's Big Data projects, these sites were not recognised in the study as being independent cases, but rather as different units of analysis of one case study. It would be interesting to see multiple cases in the same industry being investigated in order to further expand the sample. Moreover, the interview respondents for this study were primarily from the ranks of senior management, along with some external partners. Further data could be obtained from the corporation's general employees to increase the validity of those findings. In addition, as the data were collected while the Big Data project was still in the development stage it would be interesting to see what was the end result of the company's Big Data implementation effort.

The study adopted a qualitative methodological approach to conduct the research. While the method came recommended and was well-suited to this kind of research, which examines a novel research context (Yin, 2009), perhaps some additional data from survey-based method would result in more generalisable findings.

## 7.4 Further Research

Having outlined the overall process, and the managerial and organisational activities for Big Data initiatives, and the development of required capabilities in an MNC in the pharmaceutical industry, many questions regarding the process remain unanswered. As was outlined in the beginning of this study, the successful adoption of a new resource is often not an easy task to achieve using existing systems and processes. The interaction between organisations and digital technology is '*complex*' because it is influenced by many factors (McAfee and Brynolfsson, 2012). Further research should investigate the micro-foundations of these processes, and the factors that influence these activities. For example, further research could explore how political challenges (data governance, data privacy, data management laws) are affecting the development of Big Data capabilities, as this was one of the most highly-acknowledged challenges in the case-study company. However, it was out of the scope of the research to explore this further. Future research could also, for example, explore how the use of tools that do not have market strategy as their basis, such as: events, demonstrations, networking, sponsoring, research, publications, and companies can overcome and reshape the *rules of the game* of Big Data initiatives. It would also be interesting to further explore how pressures driven by social media and education affect Big Data transformation and capability development in MNCs in different industries.

Since Big Data initiatives and dynamic capabilities evolve over time (Teece, 2007; Helfat and Peteraf, 2009; Wamba et al., 2015; Mikalef et al., 2017) future studies could also adopt a longitudinal research design. Such a study design could be helpful in understanding not only the process of the implementation of Big Data initiatives and the development of required capabilities, but also the effectiveness of new capabilities. Given that the research has identified new capabilities for Big Data initiatives for the MNC in a pharmaceutical company, such as sophisticated infrastructure capability (the ability of the technology and technical software) and a data-driven culture, more research also is needed to understand its applicability i.e. the extent to which these capabilities impact other types of firms, for example those of Small and Medium Size (SMEs) and those in other industries.

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# Appendix 1: The research Context

**Big Data Challenges, Opportunities and Required Capability Development in a company with the Big Data Project**

## The research project

The project aims to consider how big data initiatives are approached in practice. Particularly, how an organisation approach the issue of using big data strategically and how they develop their capabilities for big data. As the availability of customer data escalates, there is evidence that firms have become more adept in their use of new technology to gain reliable insights from that data. Such insights influence how customers are managed and can help to shape strategic priorities. However, as well as creating commercial opportunity, this customer data also poses significant challenges for those working with it. The successful adoption of a new resource is often not an easy task to achieve as existing systems and processes need to be built up over many years, and employees' knowledge of the new environment can be limited. The interaction between organisations and digital technology is 'complex' because it is influenced by many factors, including an organisation's structure, capabilities, routines, business processes, politics, culture, internal and external environment, and management decisions. For Big data as a new strategic resource, this becomes even more complex as data sources bring additional challenges in terms of volume, variety, privacy and security. Given the importance of the emerging context of big data, the project aims to understand how firms are responding to the challenges, the rewards that they are gaining, what are the capabilities required to effectively use big data and how do firms develop capabilities to effectively use big data.

## Relevance to the company International

The ….. International's commitment and involvement to an innovative approach for big data management makes the firm an ideal site for data gathering. Big data initiatives within the company for better managing patients in the era of data driven medicine exemplifies the potential of enhanced data availability to empower patients, generate business opportunities, and strengthen customer relationships. This research project provides the opportunity to study how the project members are handling these opportunities and challenges and how they develop big data capabilities:

- What challenges does company face when capturing and dealing with this kind of new data?
- How does access to such data alter the relationships between the company and their clients?
- How is the big data changing working practices?
- What are the implications for required capabilities to effectively use big data for their operational activities and how they develop it.

In conducting this research, I am committed to aligning academic research in strategy and big data with the needs of business.

## What we seek from you

I aim to conduct research interviews with project members who are involved in big data management processes. (E.g. decision makers, data specialist, IT and marketing managers, general employers). The interviews would cover a range of issues concerning how company capture and handle the available new type of data what challenges they face in so doing, what activities they implement to develop required capabilities for new type of data and how this is impacting on their ways of working.

Each interview would take no more than one hour and would be for academic research purposes only. The interview will be arranged at a time and on a date suitable for the participant. Data from the interview will be used only for academic research purposes and will not be attributable to the individual supplying it. The data will be handled in accordance with data protection rules.  The interviews would be conducted by Ketty Grishikashvili, a PhD researcher at the Open University.

I hope there will be the opportunity in the future to develop the research into a larger scale study of the Celgene network

## **What we can offer in return**

I will happily share research findings regarding big data opportunities and challenges to date with you. I will also provide conclusions and an overview of the research finding.  I hope, for example, to offer valuable insights from the …….. community about good working practices around the use of client data and also to shed light on some of the challenges faced.  These insights might help to shape future training and support for the network, or even offer further clues on how to develop required capabilities for effectively management big data.

Ketty Grishikashvili

PhD Researcher

BSc, PGD, MSc, MRes

Open University Business School.

Walton Hall, Milton Keynes,

MK 7 6 AA

# Appendix 2: A Confidential Disclosure Agreement (CDA) with Company

**Agreement to participate in a research study**

This Agreement (the "***Agreement***") is effective as of 6th June 2017 (the "***Effective Date***") by and between **Celgene Corporation** a Delaware corporation having its principal place of business at 86 Morris Avenue, 07901 New Jersey, USA (hereinafter referred to as "***Celgene***") and **Ketty Grishikashvili**, having an address at The Open University Business Scholl, Michael Young Building (D1), Walton Hall, Milton Keys, MK7 6 AA, UK (the "***Researcher***"), (each a "***Party***" and together the "***Parties***).

WHEREAS Researcher is performing a research study entitled *"Organisational Capabilities for effective utilization of Big Data"* (hereinafter *"the Study")* and has requested Celgene to participate in this Study.

WHEREAS Celgene wishes to participate in this Study.

In consideration of the mutual promises contained herein, the Parties mutually agree as follows:

1. **Participation conditions**

Celgene's participation in the Study consists in the delivery, by Celgene employees, of interviews which can take up to one hour and which will take place between June 2017 and September 2017. The data collected will be primarily qualitative based on semi-structured interviews which can be recorded. Celgene authorizes the recording of the interviews.

Participation is strictly voluntarily and Celgene is entitled to withdraw from the Study at any time, by informing the Researcher, without any adverse consequence.

The Study will not use any Celgene personal data.

Celgene acknowledges that the information provided during the interviews can be used for educational or research purposes, including publication.

2. **Confidentiality**

"Confidential Information" shall, for the purpose of this Agreement, mean all information in any form, tangible or intangible, which may be disclosed, or has been disclosed by Celgene to Researcher in writing, orally or by observation which is non-public, proprietary, a trade secret, or confidential in nature and all of the information obtained from Celgene or generated by Researcher during the course of the Study. Researcher agrees to hold in trust and confidence all Confidential Information. Researcher further agrees that it shall not disclose all or any part of such Confidential Information to any third party or make any use thereof (except to perform the Study pursuant to the provisions this Agreement), or publish or present any work which in whole or in part uses or includes Confidential Information, without the prior written consent of Celgene. Researcher agrees to restrict access to all Confidential Information to only such limited group of its authorized employees, who (i) require such information in connection with the performance of the Study under this Agreement and (ii) have agreed in writing to be bound by the terms and conditions hereof as they apply to Researcher. It is understood, however, that this restriction shall not apply to information which Researcher can demonstrate by its competent written records predating disclosure under this Agreement (i) was known to it prior to the relationship between Celgene and Researcher, (ii) was lawfully revealed to Researcher by a third party which has the legal right to disclose such information, or (iii) is or becomes

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Researcher, (ii) was lawfully revealed to Researcher by a third party which has the legal right to disclose such information, or (iii) is or becomes part of the public domain through no fault of Researcher. Researcher shall return to Celgene or destroy all Confidential Information in tangible form (including all copies, extras or derivatives thereof in any medium) within thirty (30) days after the termination of the Study, or upon request from Celgene, whichever comes first.

**3. Copyright**

Celgene hereby assigns the copyright of the contributions made during the interviews, to the Researcher, for use in education, research and publication, notwithstanding the provisions of section 2 of this agreement.

The undersigned are duly authorized to execute this Agreement on behalf of the Parties.

| **Celgene Corporation** | | **Ketty Grishikashvili** | |
|---|---|---|---|
| By: | [signature] | By: | K Gris [signature] |
| Name: | G. BARTLEMA | Name: | Ketty Grishikashvili |
| Title: | VP, IKU | Title: | Miss |
| Date: | 06/06/2017 | Date: | 05/06/17 |

# Appendix 3: Email Text for the Participants

## Email text for the participants

Dear ……..

This is a follow up to …………'s email regarding the research interviews.

I am very grateful to the company for agreeing to be the case organisation for my research and particularly appreciate each individual's participation and support.

As ……. explained in his introductory email, each interview will not take more than an hour and will be arranged at a time and on a date to suit you. Interviews could be done in a face to face (preferable) format or via Skype/ Phone. Data from the interviews will be used only for academic research purposes and will not be attributable to the individual supplying it. The data will be handled in accordance with data protection rules and under a Confidential Disclosure Agreement (CDA) with ………..

I would be grateful if you could let me know your availability between the 11th of September and 6th of October and your preference for the interview format. I can arrange 10 days slot for face to face format however the exact dates of the slot will depend on the availability of yourself and your colleagues. Please let me know your availability even if it is not within the suggested dates.

I look forward to hearing from you.

Best wishes,

Ketty Grishikashvili.

## Appendix 4: Information Sheet

# Information Sheet

You have been invited to take part in a research study. There is some information about the project. This will help you to decide whether you would like to part or not.

## Project Title

### Organisational Capabilities for effective utilisation of Big Data

## Researcher


**Ketty Grishikashvili**, BA, MSC, PGD, MRes (BM)

**Contact**: +44 (0)1908858935. Mob: 07841611621.

**Email**: Ketty.Grishikashvili@open.ac.uk.

The Open University Business School

Michael Young Building (D1),

Walton Hall, Milton Keynes,

MK7 6AA

## About this study

The data to be collected will be primarily qualitative based on semi-structured interviews.

Taking part in this research project is voluntary. If participant would like to take part, she or he will be given this information sheet to keep and will kindly be asked to sign consent form.

The research partners will be requested to provide up to one hour of time for interviews. This will be at their convenience place and time between May 2017 and September 2017.

The intention is to record the interviews but the participant has the option to decline the recording.

If you have questions or a complained to make you could contact to senior members of the project lead supervisor on following email Elizabeth.Daniel@.open.ac.uk. or The Open University Business School's Director of Research Programmes **Prof Emma Bell** on the following email: Emma.Bell@open.ac.uk.

## Confidentiality

The researcher commits to observe any confidentiality of data. Where required, the researcher will also honour any requirement to destroy any data materials after ending the doctoral research in December 2018.

The research will not use any personal data.

Participants have a right to withdraw from the research at any time, with no adverse consequence at all.

There has been a risk assessment in line with rigorous guidelines at the Open University, under which risk is reduced to a minimum. The researcher commits to declare any changes in risk perception accordingly.

The study is following the ethical standards and the code of practice established by the High Education Intuition (HEI). Ethical approval for this study has been obtained from **The Open University's Human Research Committee (HREC)** http://www.open.ac.uk/research/ethics/human.shtml.

## At the end of study

Research partners can request to have a copy of a summary of the research findings after completion of the project.

## Appendix 5: The Consent Form

# Consent Form

### The Faculty of Business and Law, The Open University

## Project Title

| |
|---|
| **Organisational Capabilities for effective utilization of Big Data** |

**Agreement to Participate**

I, ______________________________ (print name)

agree to take part in this research project.

I have had the purposes of the research project explained to me.

I have been informed that participation in this project is voluntary and I am free to withdraw from the research any time simply informing the researcher.

I have been assured that my confidentiality and that of my organisation will be protected as specified in the information leaflet.

I agree that the information that I provide can be used for educational or research purposes, including publication.

The interview will be audio-recorded. However, I have the option to decline the recording.

I understand that if I have any concerns or difficulties I can contact: **Ketty Grishikashvili** at: **01908858935 or** ketty.grishikashvili@open.ac.uk

If I want to talk to someone else about any aspect of my participation in this project, I can contact **Prof Emma Bell**, who is the Director of Research Programmes at the Open University Business School on her direct number: **01908655669** or by email: Emma.Bell@open.ac.uk

I assign the copyright for my contribution to the Faculty for use in education, research and publication.

Signed: Date:

# Appendix 6: The Interview Questions

**THE OPEN UNIVERSITY BUSINESS SCHOOL**

**Organisational Capabilities for Effective Utilization of Big Data**

**Interview Guide and Questions**

**Researcher**


**Ketty Grishikashvili, BA, MSC, PGD, MRes (BM)**

**Contact: +44 (0)1908858935. Mob: 07841611621.**

**Email: Ketty.Grishikashvili@open.ac.uk.**

**The Open University Business School**

**Michael Young Building (D1),**

**Walton Hall, Milton Keynes,**

**MK7 6AA**

## Respondents Name

## Interview Date

## Interview Format

# Interview Guide and Questions

## Respondent Background

1. Could you please tell me your current role? How long have you been working with the company and what are your main responsibilities?

2. For how long have you been working in IKU project and what has been changed in in your responsibilities?

## Companies /Project Background

3. What are the key relationships to the Company, (customers, consumers, suppliers, competitors)?

4. What would you think are the strengths of the company? People, skills technology?

5. Does the company has any established mechanisms processes to systematically scan for new opportunities? How do they look like can you give me one example of it?

6. What would you say are the major aims and objectives of this ongoing project? How big is the project? When did it start and for how long has it been going.

## Big Data in the Project

7. What is the main reason why the company started employing big data initiatives? How would you define big data for the project?

8. How did the big data idea appear in the company? Who thought of the big data adoption idea and why? Who was involved in the decision to adopt big data (inside and outside the company)?

9. What are the company/ project's main expectation using big data? Before adopting big data did you predict where it could contribute best?
   Do you have any specific objective that you are looking to answer with this project?

10. Was there any effort made to analyse and redesign any managerial or organisational processes before the adoption of big data initiatives?

11. Could you please talk me through one example of any changes are currently going on?

12. Are there any specific requirements for being part of this project? Who are the project participants?

13. Are there any external experts involved in the project? (IS/IT, data analytics, Relationship Marketing consultant, etc.) (Understand need for additional capabilities)

## Existing Capabilities (marketing, IT) and other resources on place ( experiences, skills)

14. Were there any activities taken by the organisation's management to support, guide, or assist the implementation of big data before the project started? /Ongoing?

15. How would you describe main abilities (capabilities) company had in place when the project started? For example (understanding of customer behavior building good relationship with customers, manage market knowledge any established IT project software?

16. What is company's experience (IT & Marketing capabilities) of working with client data? Do you gather data from sources other than the client him/herself?

If yes

17. What source do you use to gather additional information about your client, do you use social media as a source for example? What approaches do you , which data gathering tools?

18. What is your experience of working with big data? Has access to these data resulted in you having a better understanding of customers or has it changed the ways you manage your customers? If so could you please give me some examples?

19. What is the main novelty of the project? Which processes are involved in the adoption/acquisition (developed especially for the company, a software package bought in, contracting a consultant, etc.) and why?

20. What is the existing IT infrastructure? What other software packages exist in the company Data Warehouse, Call Centre, Web site, etc. Which of these systems are integrated into big data project?

21. Have there been any problems with utilisation this new technology? What could have been done to help?

## Current Big data challenges and changes

22. What are the most important changes which are currently going on? Could you please talk me through one example of any changes?

23. Does top management create mechanisms to link different organisational teams, routines, capabilities related to this project?

24. Were there any changes in the processes? What?

25. Have there been any changes in the organisational structure related to big data? Redesigning of business processes?

26. Has it effected strategic level or more tactical/operational?

27. What particular challenges have these changes brought?

28. Do you think that there are the challenges that might contribute to the failure of the project? For example looking at these changes are there any resources or capabilities which are no longer needed which are maintained or need further improvement?

29. What do you think happening to the capabilities in general of the organisation during this project? Do you think there is a need for new capabilities and if yes what kind of?

30. What would you think are the strengths and novelty of this project? Have there been any efforts made to develop any additional capabilities in order to successfully deliver this project. Have there any need for additional capabilities been identified?

## Digital Skills

31. What kind of actions are conducted by company's managers to make the big data initiative effective? Can you give me an example?

32. Were there any activities taken by the company's' management to support, guide, or assist the implementation of Big Data within company? What kind of activities? Any trainings? Additional learning programs?

33. What kind of training was conducted in the company in relation to big data initiative? Who was involved? Who provided the training?

34. Have there been any periodical training sessions conducted?

35. How often do you have training about technical tools and/or software packages that you are using?

36. Which new packages and technical/practical tools do you use? And how it is different from previous one?

37. What difficulties do you face when using new approach?

38. Do you share information and/or best practice suggestions with other project members or concurrent companies?

39. What are the communication channels or meeting points available where project members can share experiences (positive and negative) about the project?

## Closing Questions

40. What are the big (remaining) challenges you face when dealing with new type of data?

41. What are the future perspectives that you are looking at from adopting big data?

42. Is there anything you would like to add at the end of our interview

# Thank you

# **Appendix 7:** The Ethical Aproval

The Open University

| | |
|---|---|
| From | Dr Louise Westmarland<br>Chair, The Open University Human Research Ethics Committee |
| Email | Louise.westmarland@open.ac.uk |
| Extension | 52462 |
| To | Ketevani (Ketty) Grishikashvili FBL |
| Subject | Dynamic Capabilities and Big Data: An Empirical Study in the Financial Services Sector |
| Ref | HREC 2016 2395 Grishikashvili |
| AMS (Red) | |
| Submitted | 22/09/2016 |
| Date | 11/10/2016 |

Memorandum

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This memorandum is to confirm that the research protocol for the above-named research project, as submitted for ethics review, **has been given a favourable opinion** by the Open University Human Research Ethics Committee by **Chair's action** as it is thought to be low risk. Please note that the OU research ethics review procedures are fully compliant with the majority of grant awarding bodies and their Frameworks for Research Ethics.

Please make sure that any question(s) relating to your application and approval are sent to Research-REC-Review@open.ac.uk quoting the HREC reference number above. We will endeavour to respond as quickly as possible so that your research is not delayed in any way.

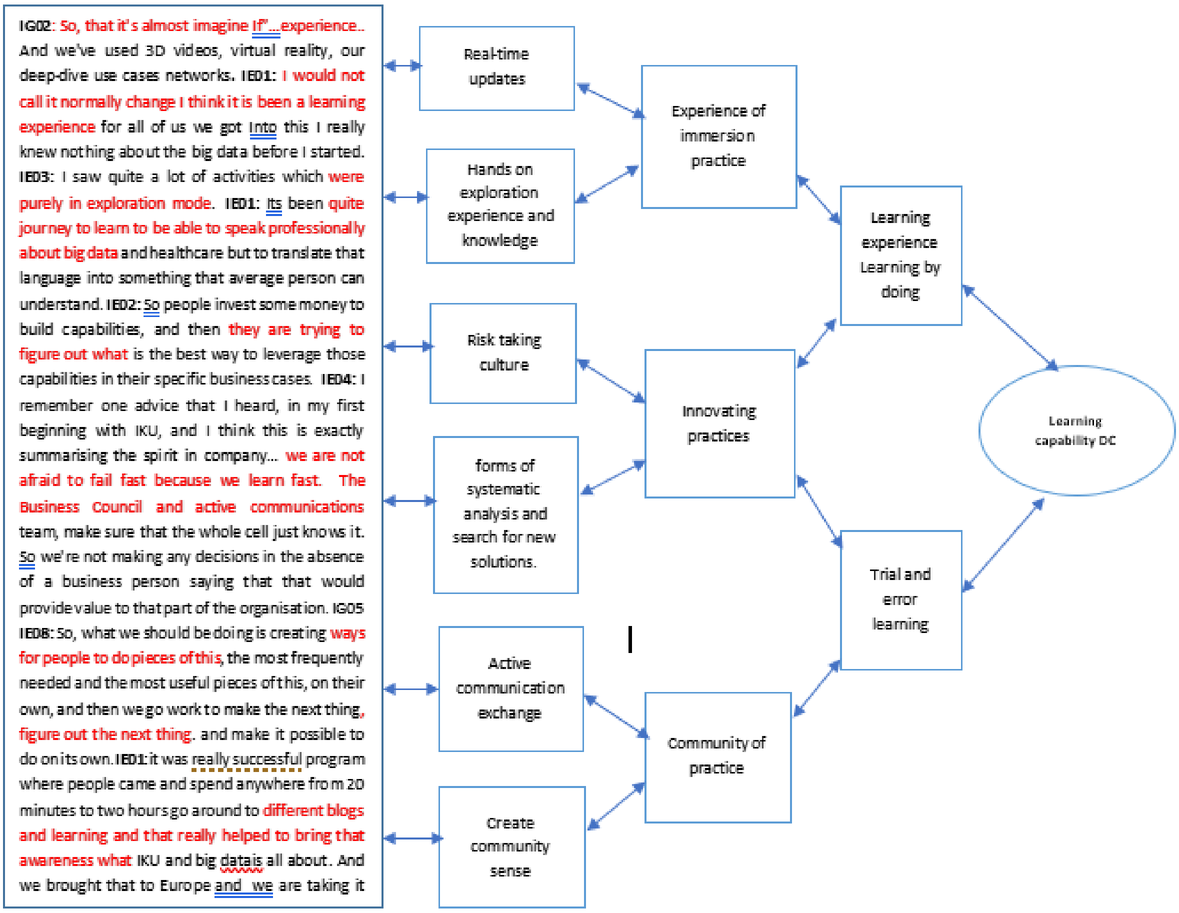
At the conclusion of your project, by the date that you stated in your application, the Committee would like to receive a summary report on the progress of this project, any ethical issues that have arisen and how they have been dealt with.

Kind regards,

Dr Louise Westmarland

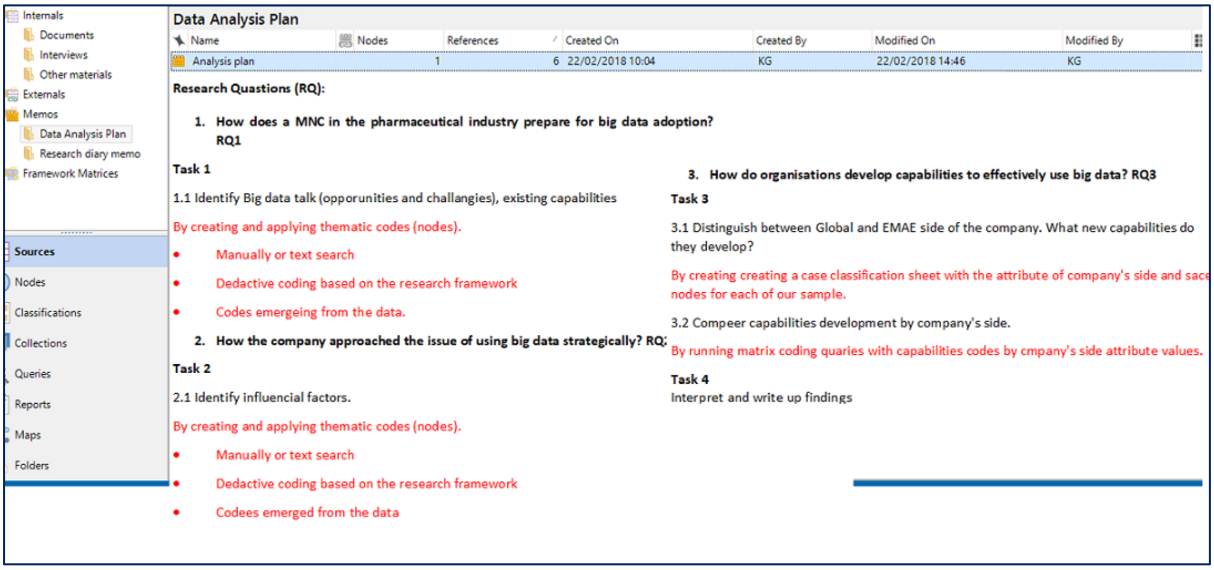
Chair OU HREC

# Appendix 8: Example of data analysing process, using the analytical framework (coding structure).

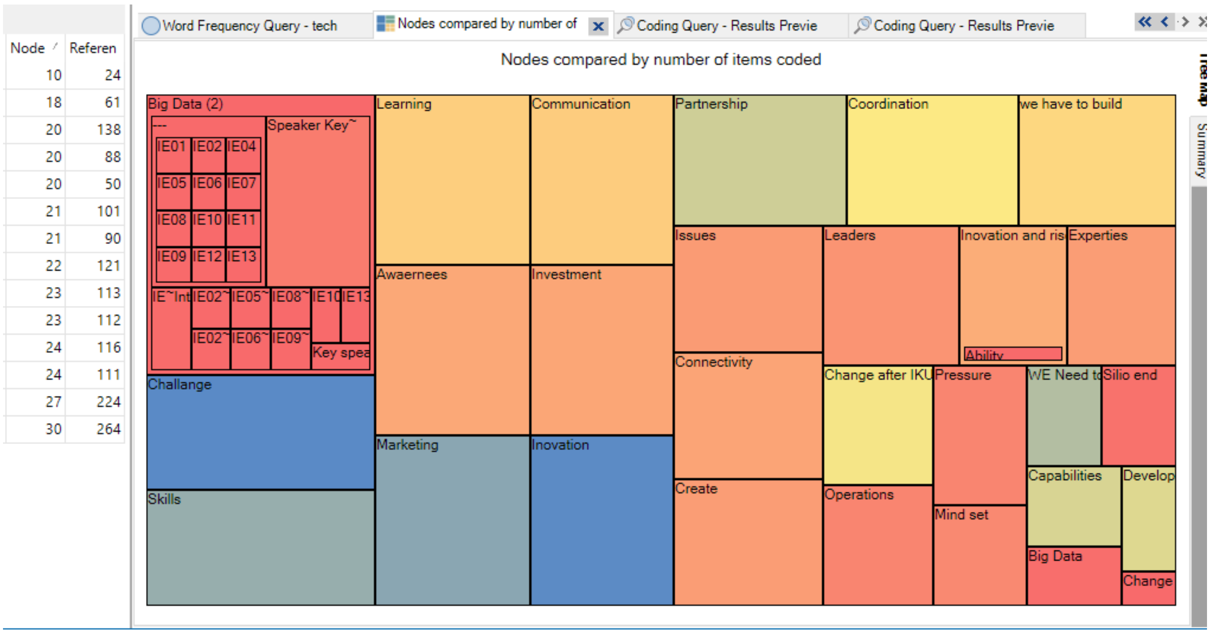


# Appendix 9: Data Analysis Plan and Process Examples

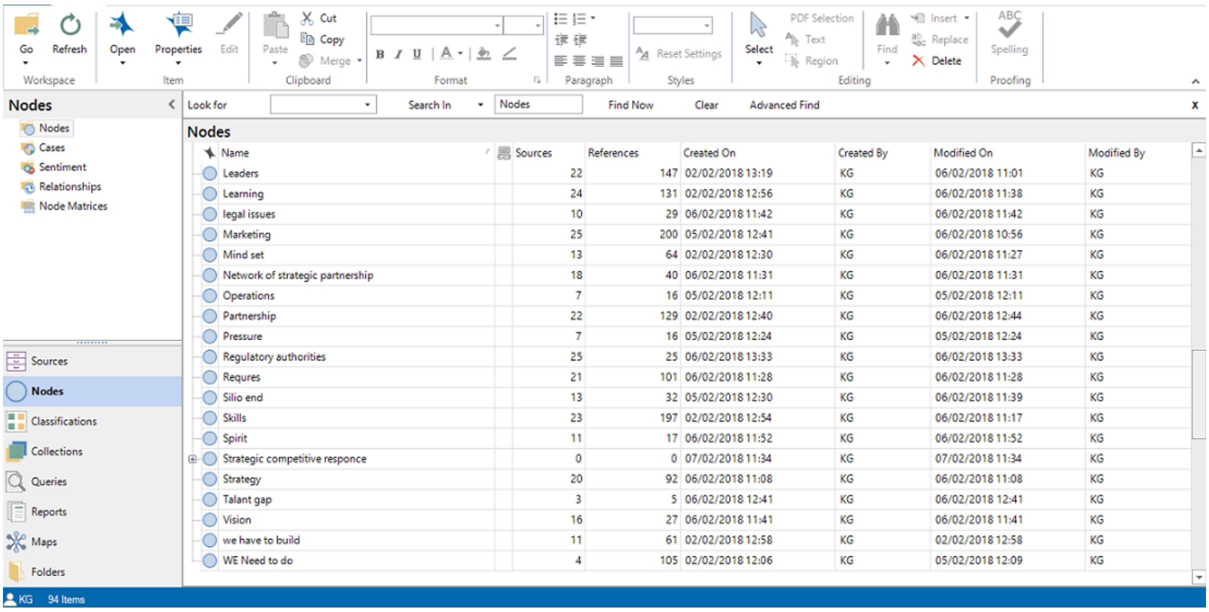
Data analysis Initial Plan




**Data Analysis's process: searching for the terms, phrases or meanings that were common between the interviewees.**



# Appendix 10: Nvivo 11 nods and codes examples



Nodes

| Name | Sources | References | Created On | Created By | Modified On | Modified By |
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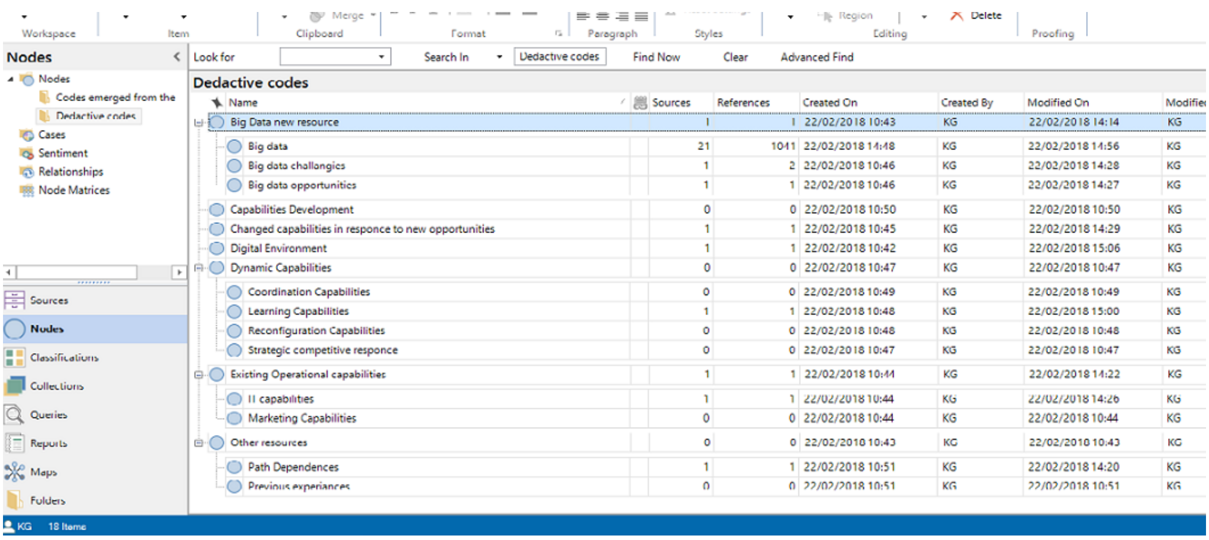
| Learning | 24 | 131 | 02/02/2018 12:56 | KG | 06/02/2018 11:38 | KG |
| legal issues | 10 | 29 | 06/02/2018 11:42 | KG | 06/02/2018 11:42 | KG |
| Marketing | 25 | 200 | 05/02/2018 12:41 | KG | 06/02/2018 10:56 | KG |
| Mind set | 13 | 64 | 02/02/2018 12:30 | KG | 06/02/2018 11:27 | KG |
| Network of strategic partnership | 18 | 40 | 06/02/2018 11:31 | KG | 06/02/2018 11:31 | KG |
| Operations | 7 | 16 | 05/02/2018 12:11 | KG | 05/02/2018 12:11 | KG |
| Partnership | 22 | 129 | 02/02/2018 12:40 | KG | 06/02/2018 12:44 | KG |
| Pressure | 7 | 16 | 05/02/2018 12:24 | KG | 05/02/2018 12:24 | KG |
| Regulatory authorities | 25 | 25 | 06/02/2018 13:33 | KG | 06/02/2018 13:33 | KG |
| Requres | 21 | 101 | 06/02/2018 11:28 | KG | 06/02/2018 11:28 | KG |
| Silio end | 13 | 32 | 05/02/2018 12:30 | KG | 06/02/2018 11:39 | KG |
| Skills | 23 | 197 | 02/02/2018 12:54 | KG | 06/02/2018 11:17 | KG |
| Spirit | 11 | 17 | 06/02/2018 11:52 | KG | 06/02/2018 11:52 | KG |
| Strategic competitive responce | 0 | 0 | 07/02/2018 11:34 | KG | 07/02/2018 11:34 | KG |
| Strategy | 20 | 92 | 06/02/2018 11:08 | KG | 06/02/2018 11:08 | KG |
| Talant gap | 3 | 5 | 06/02/2018 12:41 | KG | 06/02/2018 12:41 | KG |
| Vision | 16 | 27 | 06/02/2018 11:41 | KG | 06/02/2018 11:41 | KG |
| we have to build | 11 | 61 | 02/02/2018 12:58 | KG | 02/02/2018 12:58 | KG |
| WE Need to do | 4 | 105 | 02/02/2018 12:06 | KG | 05/02/2018 12:09 | KG |



Dedactive codes

| Name | Sources | References | Created On | Created By | Modified On | Modified By |
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| Big data | 21 | 1041 | 22/02/2018 14:48 | KG | 22/02/2018 14:56 | KG |
| Big data challangies | 1 | 2 | 22/02/2018 10:46 | KG | 22/02/2018 14:28 | KG |
| Big data opportunities | 1 | 1 | 22/02/2018 10:46 | KG | 22/02/2018 14:27 | KG |
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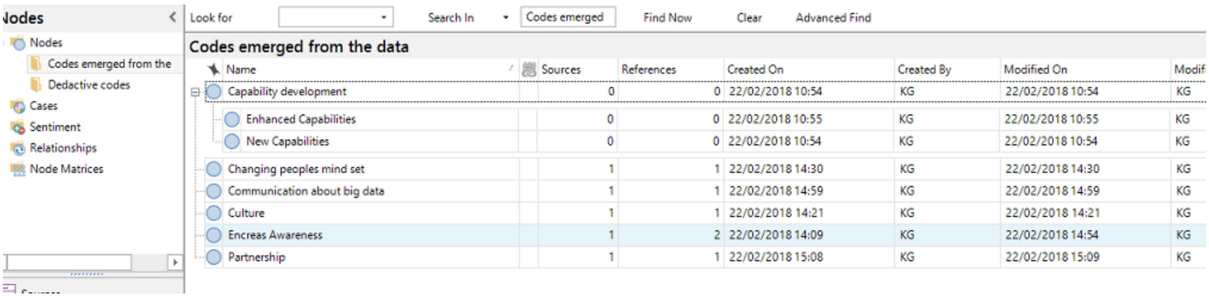
| Changed capabilities in responce to new opportunities | 1 | 1 | 22/02/2018 10:45 | KG | 22/02/2018 14:29 | KG |
| Digital Environment | 1 | 1 | 22/02/2018 10:42 | KG | 22/02/2018 15:06 | KG |
| Dynamic Capabilities | 0 | 0 | 22/02/2018 10:47 | KG | 22/02/2018 10:47 | KG |
| Coordination Capabilities | 0 | 0 | 22/02/2018 10:49 | KG | 22/02/2018 10:49 | KG |
| Learning Capabilities | 1 | 1 | 22/02/2018 10:48 | KG | 22/02/2018 15:00 | KG |
| Reconfiguration Capabilities | 0 | 0 | 22/02/2018 10:48 | KG | 22/02/2018 10:48 | KG |
| Strategic competitive responce | 0 | 0 | 22/02/2018 10:47 | KG | 22/02/2018 10:47 | KG |
| Existing Operational capabilities | 1 | 1 | 22/02/2018 10:44 | KG | 22/02/2018 14:22 | KG |
| IT capabilities | 1 | 1 | 22/02/2018 10:44 | KG | 22/02/2018 14:26 | KG |
| Marketing Capabilities | 0 | 0 | 22/02/2018 10:44 | KG | 22/02/2018 10:44 | KG |
| Other resources | 0 | 0 | 22/02/2018 10:43 | KG | 22/02/2018 10:43 | KG |
| Path Dependences | 1 | 1 | 22/02/2018 10:51 | KG | 22/02/2018 14:20 | KG |
| Previous experiances | 0 | 0 | 22/02/2018 10:51 | KG | 22/02/2018 10:51 | KG |



Codes emerged from the data

| Name | Sources | References | Created On | Created By | Modified On | Modif |
|---|---|---|---|---|---|---|
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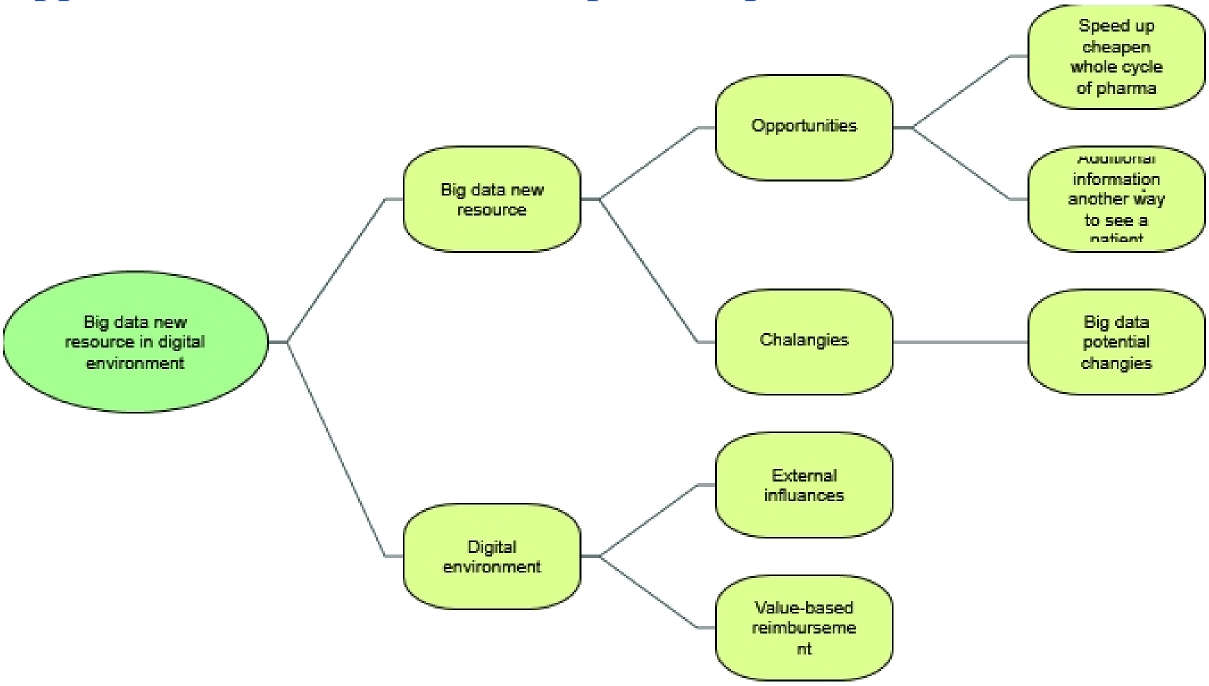
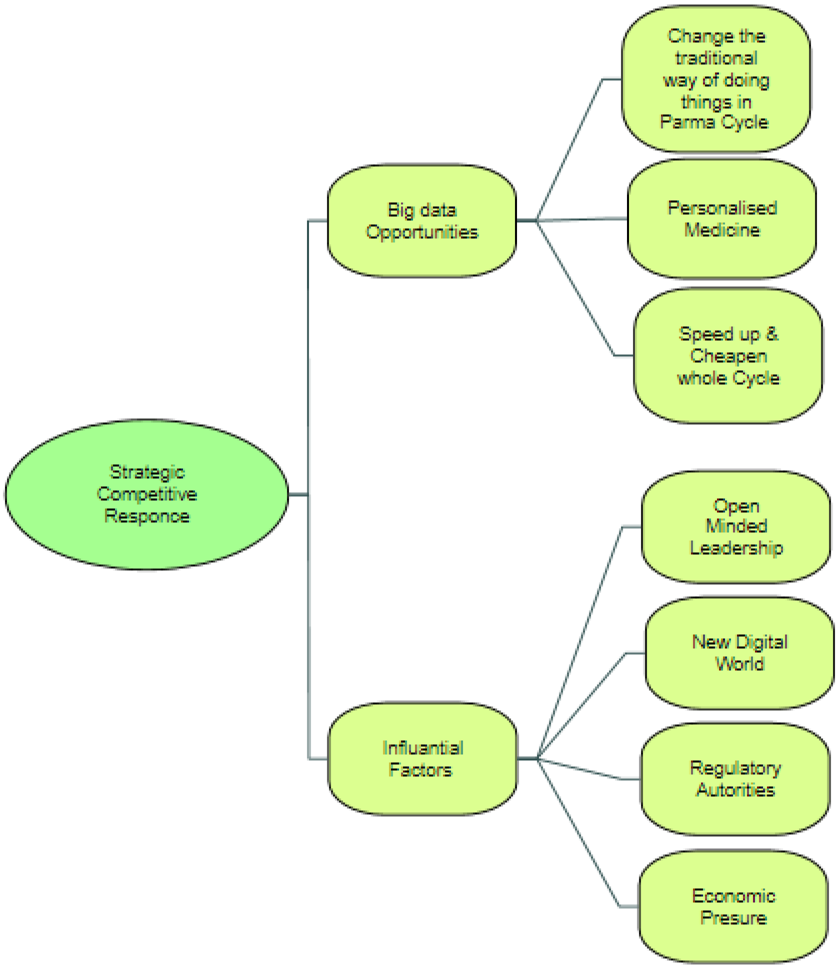
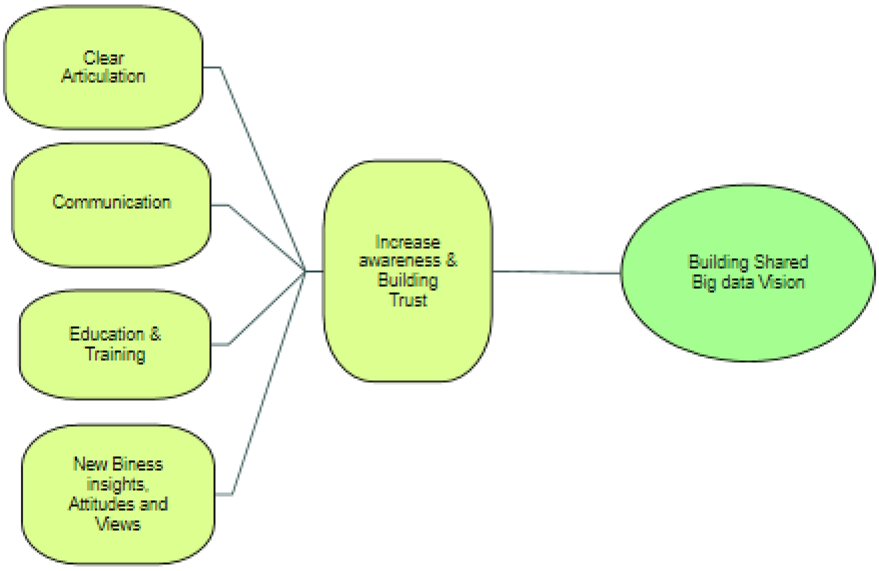
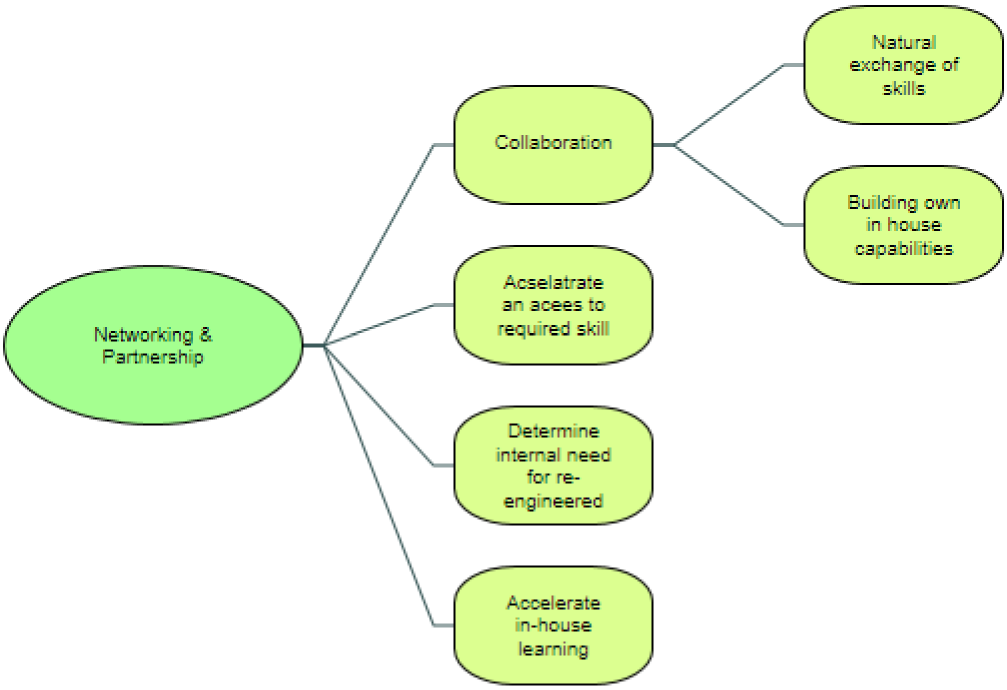
| Enhanced Capabilities | 0 | 0 | 22/02/2018 10:55 | KG | 22/02/2018 10:55 | KG |
| New Capabilities | 0 | 0 | 22/02/2018 10:54 | KG | 22/02/2018 10:54 | KG |
| Changing peoples mind set | 1 | 1 | 22/02/2018 14:30 | KG | 22/02/2018 14:30 | KG |
| Communication about big data | 1 | 1 | 22/02/2018 14:59 | KG | 22/02/2018 14:59 | KG |
| Culture | 1 | 1 | 22/02/2018 14:21 | KG | 22/02/2018 14:21 | KG |
| Encreas Awareness | 1 | 2 | 22/02/2018 14:09 | KG | 22/02/2018 14:54 | KG |
| Partnership | 1 | 1 | 22/02/2018 15:08 | KG | 22/02/2018 15:09 | KG |

# Appendix 11: Nvivo11 Mind Maps Examples




Clear Articulation
Communication
Education & Training
New Biness insights, Attitudes and Views
Increase awareness & Building Trust
Building Shared Big data Vision


Networking & Partnership
Collaboration
Natural exchange of skills
Building own in house capabilities
Acselatrate an acees to required skill
Determine internal need for re-engineered
Accelerate in-house learning